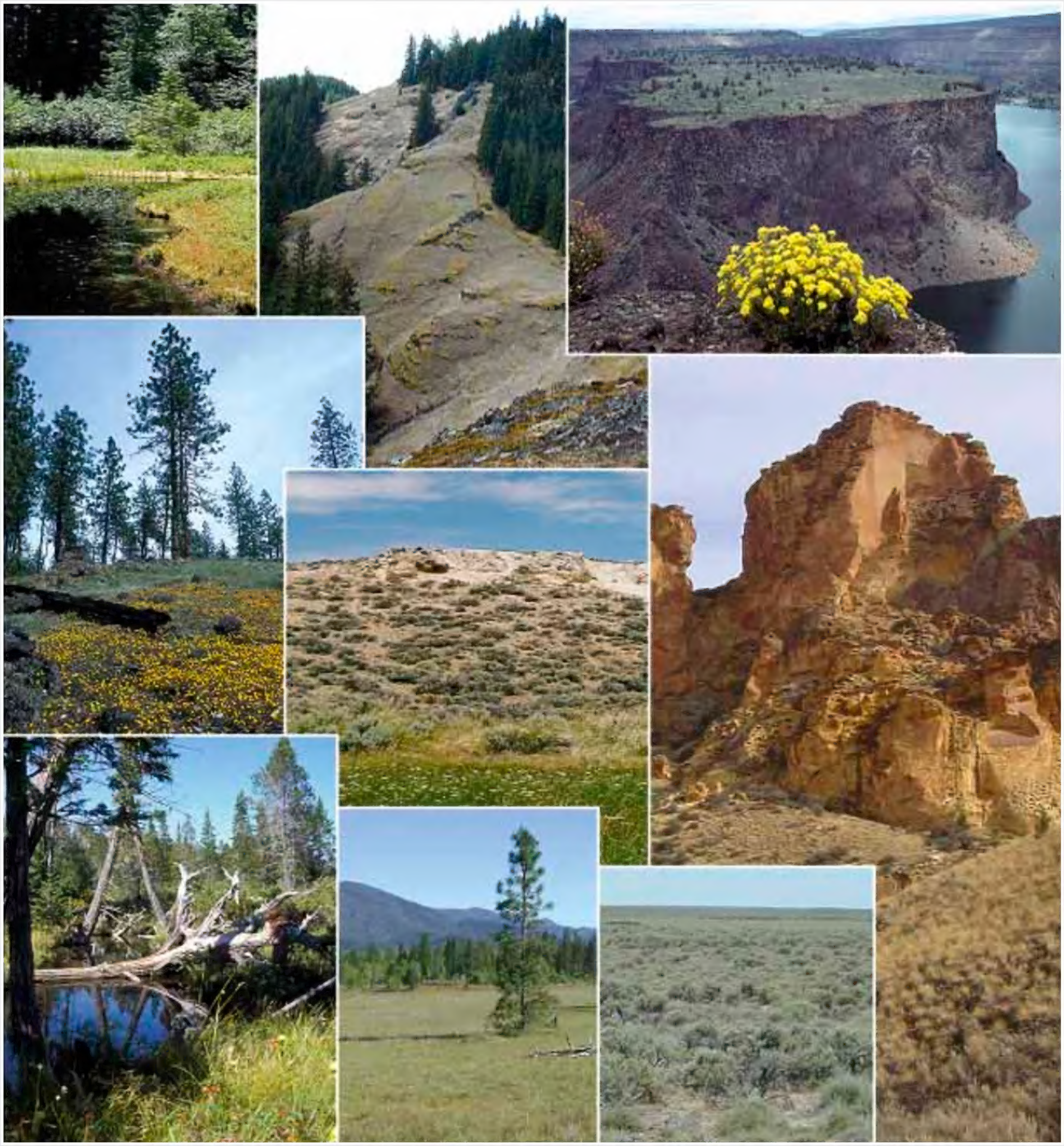
KALMIOPSIS

Journal of the Native Plant Society of Oregon



Oregon Plants, Oregon Places

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KALMIOPSIS

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EDITORIAL

The Oregon Plants, Oregon Places series, started by Editor Frank Lang in the second issue of Kalmiopsis (1992), has been a popular feature of our journal. Here, in our first theme issue of *Kalmiopsis*, botanists from each of the nine Bureau of Land Management districts in the state give us a sampling of the botanical diversity throughout Oregon. Four articles from eastern Oregon tell us about sagebrush steppe and Juniper bunchgrass habitats, including rare endemics on ash deposits (Leslie Gulch, Guano Creek/Sink Lakes), a natural playa system (Foster Flat), and an ungrazed plateau (The Island). In western Oregon, two articles unveil the mysteries of fens (White Rock Fen, Hunter Creek). Three areas protect serpentine-influenced habitats (Hunter Creek, French Flat, and Beatty Creek). Rock outcrops at Beatty Creek and Horse Rock Ridge support a variety of species adapted to drought where precipitation is plentiful. On behalf of NPSO, I thank the BLM botanists who, in addition to working to protect our botanical heritage on public land, wrote the articles: Joan Seevers, Jean Findley, Lucile Housley, Nora Taylor, Ron Halvorson, Barbara Raible, Nancy Brian, Mark Mousseaux, Susan Carter, and Doug Goldenberg. I hope to be fortunate enough to visit every one of these ACECs in the coming years.

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Membership in the Native Plant Society of Oregon is open to all.
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COVER PHOTOS: Oregon Plants, Oregon Places

Clockwise from upper left corner: White Rock Fen (Barbara Raible), Horse Rock Ridge (Cheshire Mayrsohn), The Island (Ron Halvorson), Leslie Gulch (Bob Alward), Foster Flat (Nora Taylor), French Flat (Tom Kaye), Hunter Creek Bog (Veva Stansell), Beatty Creek (Russ Holmes), and in center, Guano Creek/Sink Lakes (Lucile Housley).

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Oregon Plants, Oregon Places: BLM Botanical Areas

Joan Seevers
BLM OR/WA Botany Program Lead, 333 SW 1st Ave., Portland, OR 97204

Welcome! I invite you to explore the botanical treasures on Oregon public lands administered by the US Bureau of Land Management (BLM). Start with an armchair tour as you read about a sampling of special places known as Areas of Critical Environmental Concern (ACEC). BLM botanists and ACEC coordinators have prepared nine written tours for you of their favorite ACEC areas. These serve as just a glimpse of the many botanical trips that you may wish to plan for exploring plants and places in the nine BLM districts in Oregon.

In Oregon, BLM manages over 17 million acres of public lands. Scattered throughout these millions of acres are 200 ACECs. Over 90% of them are designated for their special botanical features, including unique or outstanding plant communities. These 200 areas harbor a multitude of rare, endemic, or relic plants, many left in refugia from earlier times. ACEC sites range from sea level at Yaquina Head Outstanding Natural Area (a special subset of the ACEC designation) to the top of Steens Mountain at 9,670 feet. North, south, east, and west, you will find magnificent areas filled with botanical treasures hidden away on public lands. Some sites are as small as ten acres, but their importance vastly exceeds their size. These small areas may encompass the only known population of a listed plant, or protect one of only a few populations, providing the opportunity for implementation of a recovery plan. (Unlike animals, plants listed under the Endangered Species Act receive protection only on public lands.) Other ACEC areas sprawl over thousands of acres of remote, open landscape, and encompass a variety of plant communities that can provide countless hours of botanical exploration.

Since you may be wondering, "What is an Area of Critical Environmental Concern?" I will define ACECs and their special role in land use planning on the public lands. The ACEC designation comes to us through Section 2202 (c) (3) of Public Law 940579, the Federal Land Policy and Management Act (FLPMA) of 1976. The Act defines an ACEC as an area "within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values; fish and wildlife resources or other natural systems or processes; or to protect life and safety from natural hazards." Botanical resources fall under "other natural systems or processes." BLM's 1613 Planning Manual describes Natural Process or System as "endangered, sensitive, or threatened plant species; rare, endemic, or relic plants or plant communities which are terrestrial, aquatic or riparian; or rare geological features."

An ACEC designation indicates that BLM recognizes the significant values of the area and intends to manage it to protect and enhance those resource values. Designation and management apply only to public lands. Private lands within or adjacent to ACEC boundaries are not affected by these designations or management prescriptions. In addition to identifying areas to be designated as ACECs, BLM's Resource Management Plans (RMP) outline management objectives and prescriptions for each ACEC. An activity plan may be prepared for the ACEC when additional management direction, beyond that included in the RMP, becomes necessary to meet management objectives, deal with public uses, or respond to applications for land use authorizations. Development of the activity plan follows the general objectives outlined in the designation.

Management prescriptions may include the following activities: posting boundaries, installing information signs, inventory and monitoring, acquisition of access, and resolution of unauthorized uses. Where appropriate or necessary, additional lands may be acquired from willing parties to meet management objectives. An example of land acquisition is Beatty Creek RNA, where over 600 acres were acquired through land exchange. Although land acquisitions can take years of planning and negotiation, they are an essential tool for protecting intact communities.

The ACEC designation is also an umbrella for two other types of special areas on public lands: Research Natural Areas (RNA) and Outstanding Natural Areas (ONA). "Research Natural Area" means an area that is established and maintained for the primary purpose of research and education. RNAs are a nation-wide interagency program. The Pacific Northwest's first RNA was designated in 1931 by the US Forest Service on part of the Metiolus River. Although the BLM began setting aside RNAs later than the Forest Service, by 1987 it had established 27 RNAs, and today has 64 designated RNAs. These areas protect both unique and typical "benchmark" terrestrial and aquatic ecosystems. The Oregon Natural Heritage Program maintains a list of plant community cells that represent all plant communities in Oregon, for which RNAs are established to protect.

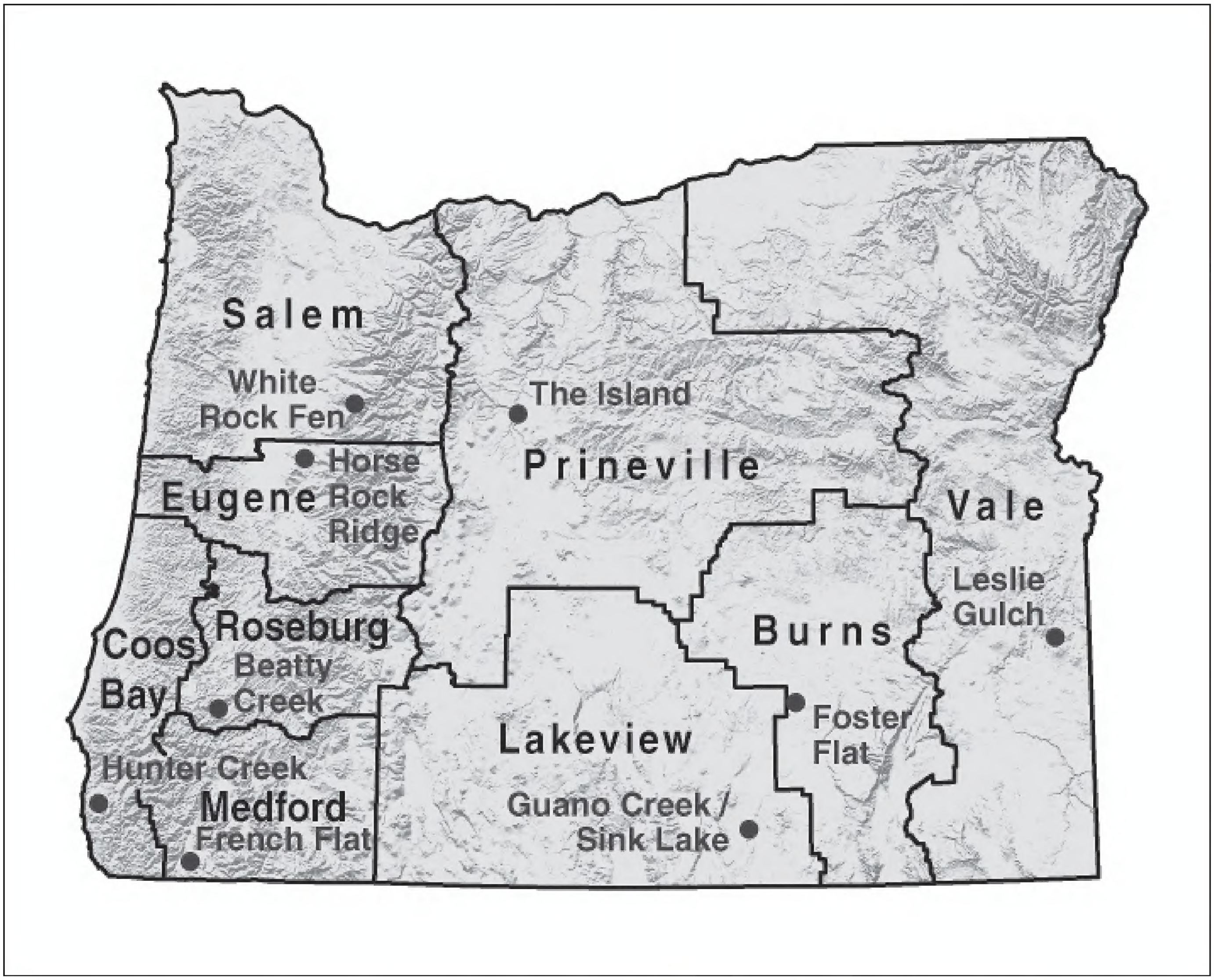
RNAs serve as outdoor laboratories and as baselines for comparing the effects of human manipulations in similar settings. Access and use are more restricted in an RNA than in an ACEC. If you are planning a group trip to an RNA, please call the appropriate BLM district office before visiting. Group numbers are limited, camping is not allowed, and other restrictions may apply. The most exclusive restrictions are found at The Island RNA in central Oregon. Access is by permit, and only to documented researchers and officially sponsored groups. Public recreational use is limited because of past adverse impacts to the ecological research values.

ONAs are areas that are essentially RNAs, but have an established recreational use, which is usually hiking. Upper Table Rock in southwestern Oregon is an example of an ONA that receives extensive use. During the spring flowering season, student groups from elementary to college level create a steady stream on the trail to the top of the rock. These areas are designated as ONAs as long as the recreational use does not adversely impact resource values. Soon an interactive list of the ACECs in Oregon and

Washington will be available on the OR/WA BLM Internet web page (http://www.or.blm.gov) where you can view a description of the area and a map of each ACEC.

I hope you enjoy your botanical forays on the public lands. I encourage you to check BLM district web pages for botanical information and ACEC information. You may also call the districts if you need addition help. Dedicated work by BLM staff, the Oregon botanists, and ACEC coordinators has made these ACECs possible. In addition, the support and the commitment of the Oregon BLM managers has been critical to designation of BLM's 200 ACECs. As land use plans continue to be revised and re-written, please take an active role in the planning process. For it is through the planning process that these special areas are designated. If you enjoy your foray and appreciate this type of land use designation for our botanical resources and unique plant communities, please let BLM managers know. As spring draws near, gather your *Kalmiopsis*, maps, field guides, and calendar to plan a variety of botanical explorations. Have a wonderful time.

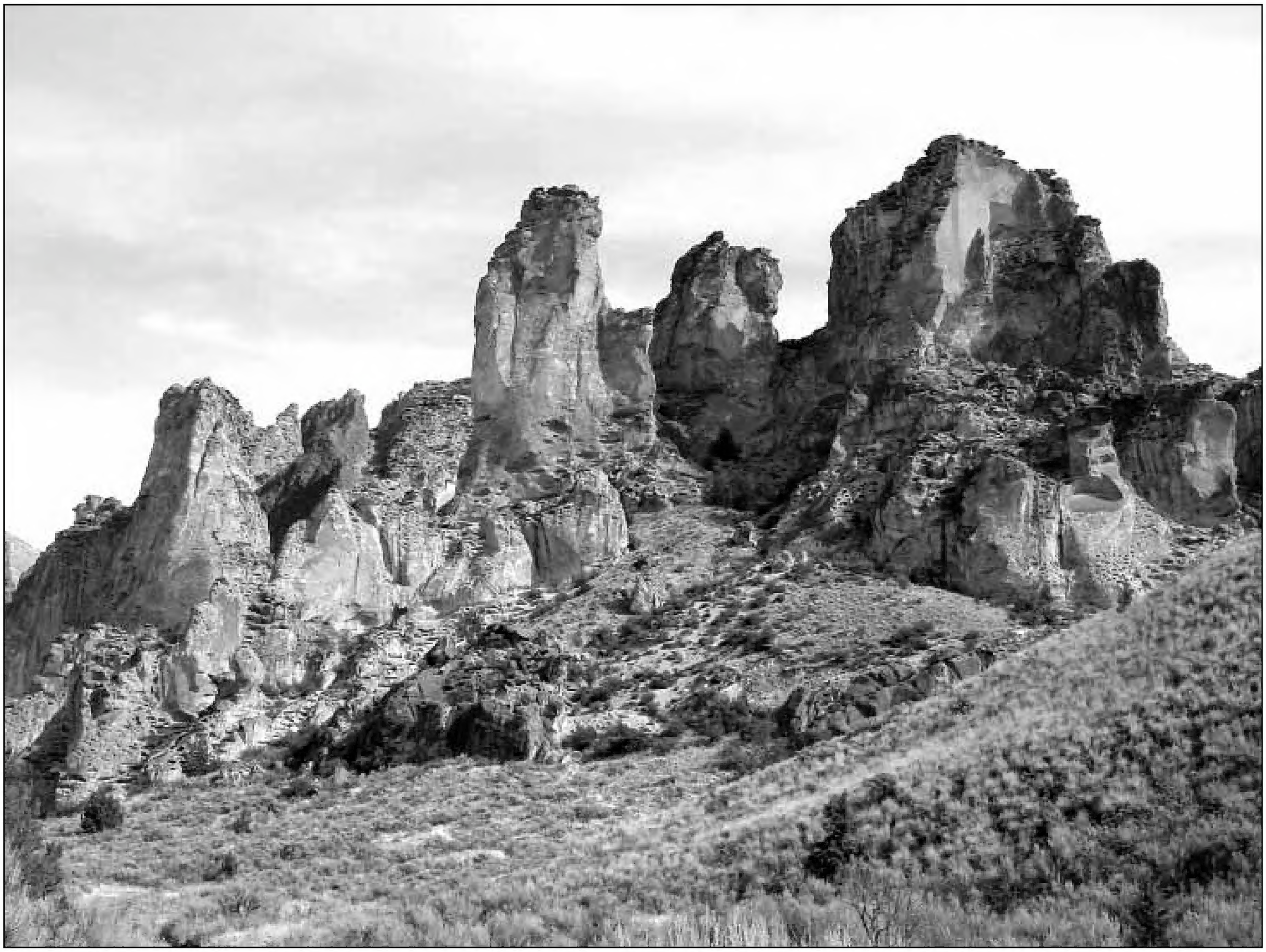
[Ed. note: This year Joan was honored with the "Karl Urban Celebrating Wildflowers Award," in recognition of her extraordinary dedication and creativity toward the National Celebrating Wildflowers Program that promotes the understanding and appreciation of the nation's botanical resources. See *Kalmiopsis* 9:26 for Karl's biography and background on this award.]



This map of the nine BLM districts in Oregon shows the location of each of the ACECs featured in the articles that follow.

Leslie Gulch

Jean Findley
Vale District BLM, 100 Oregon Street, Vale, OR 97918



Main canyon of Leslie Gulch. Photo by Bob Alward, BLM Vale District.

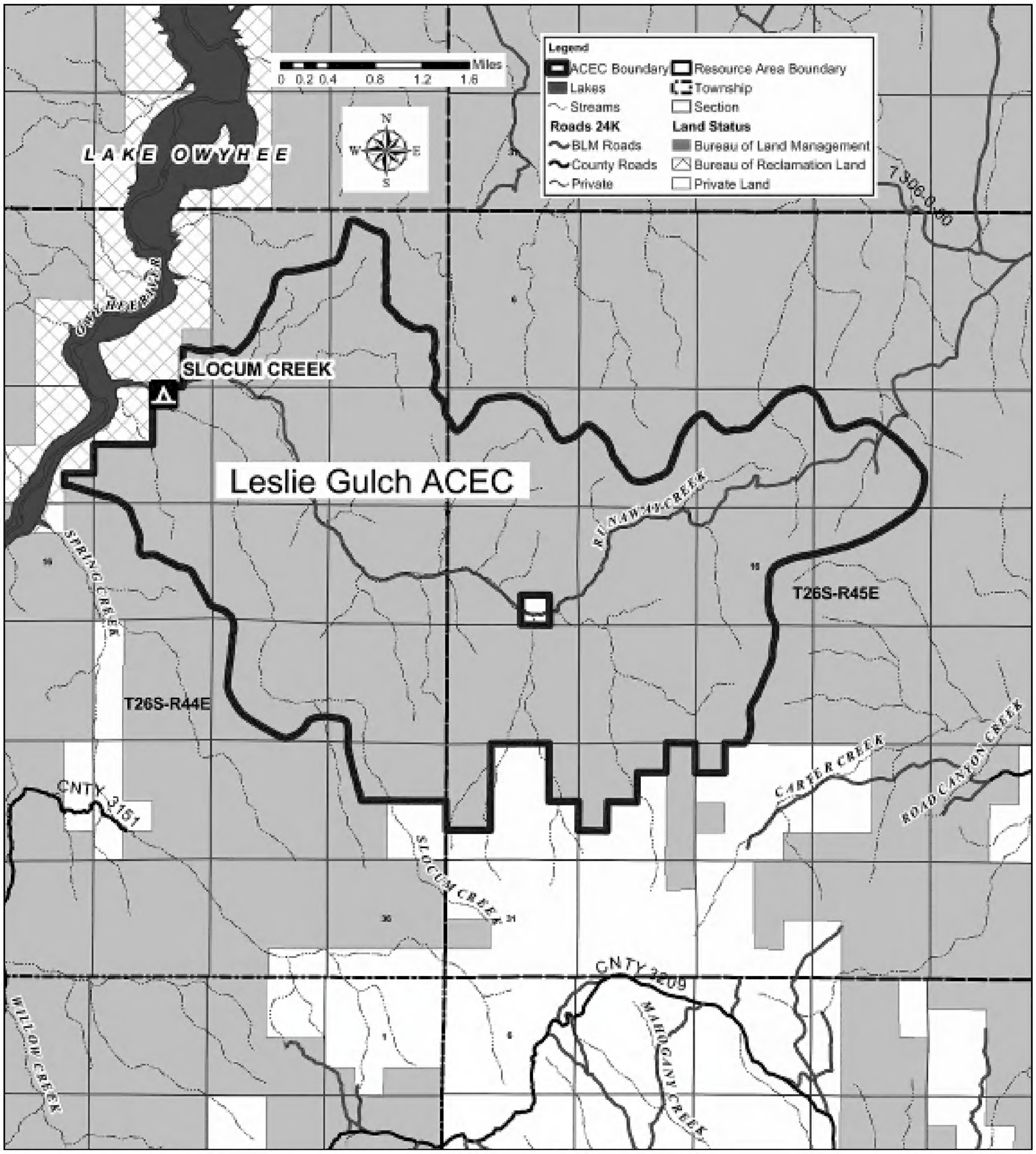
With violent explosions, the Mahogany Mountain caldera spewed hot volcanic gases, volcanic ash, and large chunks of volcanic rock in a molten froth more than 1,000 feet thick over several thousand square miles. Thus began the formation of the rosy golden cliffs of Leslie Gulch 15 million years ago, with a rhyolite pyroclastic flow. As the deposit cooled and lithified into rock, trapped gases created pockets. These cavities and differential weathering of the Leslie Gulch Ash Flow Tuff created spectacular, almost eerie, landforms that include "honeycombs" and skyline windows.

Subsequent uplift, faulting and erosion further enhanced the striking geologic formations and canyon vistas. Multiple ash layers flaunt a variety of colors ranging from yellow to green and many shades of red, often streaked with blacks and browns. In some places the tuff, a part of the Succor Creek formation, is 2,000 feet deep (Kittleman 1973). From its immense thickness, uniformity, and relative resistance to weathering were wrought impressive cliffs, outcrops, and spires. Columnar rhyolite dikes, intrusions even more resistant to the ravages of wind and water than the tuff, contrast with the soft hues of the Great Basin vegetation.

"Gulch," a quintessential Western term for the arid drainages in this harsh land, gives little indication of Leslie Gulch's violent past or the botanical treasures hidden among the fantastic rock formations of this colorful canyon. Designated an Area of Critical Environmental Concern (ACEC) for its ash-dependent rare plant species, spectacular scenery, and habitat for California bighorn sheep, Leslie Gulch lies in extreme eastern Oregon. Its gulch drains into Owyhee Reservoir approximately 50 miles south of Ontario, Oregon, and 60 miles southwest of Boise, Idaho. The 11,673 acre area was designated as a special management area in 1983 by the Bureau of Land Management (BLM), a designation carried forward into the agency's recent Southeastern Oregon Resource Management Plan (2002). The ACEC is managed under a comprehensive plan finalized in 1995 and governing a wide variety of activities. A 40-acre parcel of private land at Mud Spring lies in the heart of the ACEC, and the western fringe is bordered by land managed by the Bureau of Reclamation in conjunction with the Owyhee Reservoir. The ACEC may be reached by an all-weather road west of Highway 95 between Jordan Valley, Oregon, and Marsing, Idaho. Approximately 20 miles south of Marsing, look for small signs west and east of Highway 95 with "Leslie Gulch" in white lettering on a brown field. Turn right (west) onto this graveled road, the McBride Creek Road. Go eight miles to the red school house at Rockville and turn right (west) to cross Succor Creek, then travel one mile to the signed Leslie Gulch Road junction and turn left (west). This road leads directly to the ACEC, a distance of approximately eight miles.

Climate

Typical of the Great Basin, the climate at Leslie Gulch is one of extremes. Winter temperatures often plummet well below zero, and summer highs can exceed 100°F. While annual precipitation averages nearly eight inches, actual rainfall amounts are unpredictable. Storm events can bring several inches of rainfall within a few hours. During these times, the otherwise dry gulches turn into raging torrents which can block or wash out roads and trails. With the exception of a short section below Mud Spring, none of the drainages within the ACEC contain perennially flowing water. The ACEC is generally accessible year-round via all-weather roads, although snowfall in some years may preclude access for several weeks. Visitors are encouraged to check weather forecasts and eastern Oregon road conditions prior to departure. Vegetative growth and wildflower displays peak in late May and early June, with length and showiness dependent on temperatures and amount and timing of rainfall the previous winter and spring.

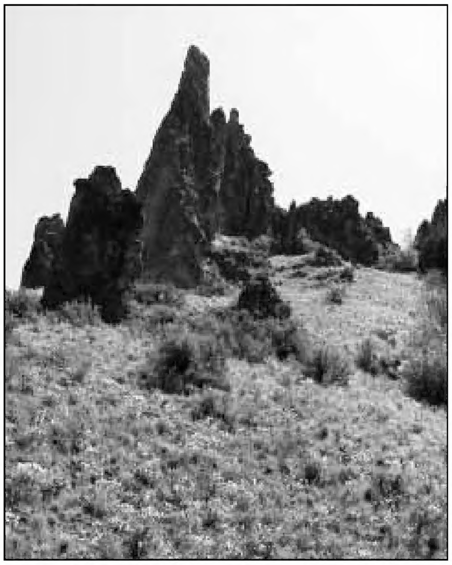


Map of Leslie Gulch ACEC, prepared by Marissa Theall, BLM Vale District.

Vegetation

At Leslie Gulch, the juxtaposition of northern and southern floras creates an unusual assemblage of species. Here, the northern mesic flora, represented by curlleaf mountain mahogany (*Cercocarpus ledifolius*), Rocky Mountain maple (*Acer glabrum*) and an isolated stand of ponderosa pine (*Pinus ponderosa*), meets a southern xeric flora of salt desert species, including greasewood (*Sarcobatus vermiculatus*), shadscale saltbush (*Atriplex confertifolia*), and spiny hopsage (*Grayia spinosa*) (Grimes 1979, 1984). Combined with the rare plant species discussed below, the vegetative elements of the ACEC give Leslie Gulch a floristic variety unexcelled in Malheur County in any area of comparable size.

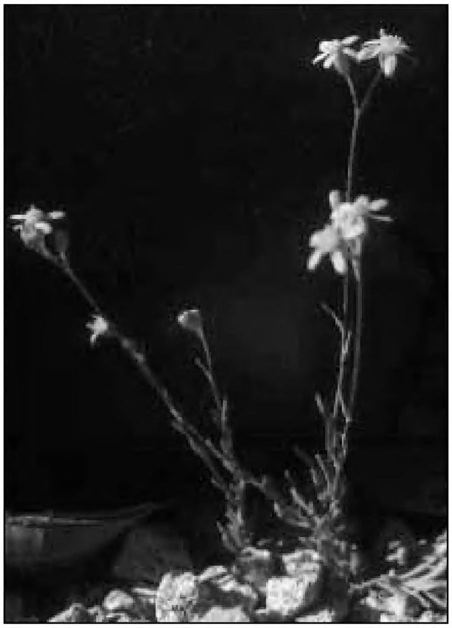
The small disjunct population of ponderosa pine grows on the crest of a rhyolitic ridge near the southern boundary of the ACEC. The closest forests of ponderosa pine lie about 70 miles away to the northwest. Among the nearly 100 trees, two individuals are over 200 years old, with the remaining trees ranging in age down to seedlings (McKee and Knutson 1987). There is no evidence indicating that this is a relict population, and speculations on origins from the west or northwest have been advanced. Because of its inaccessibility, the stand is rarely visited by livestock or humans and shows little to no sign of disturbance.



Pinnacles in a side canyon of Leslie Gulch on May 15, 2003. Photo by Bob Alward, BLM Vale District.

Rare Plants

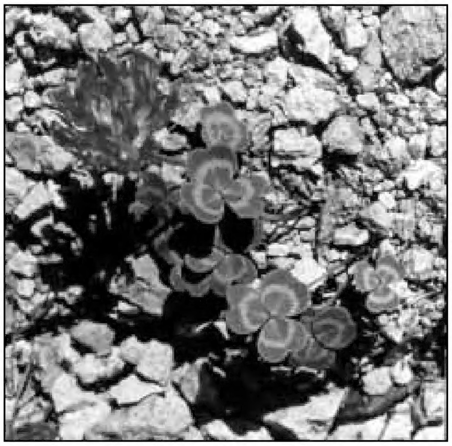
Five plant species found on the unusual ash formations within the canyon were formerly considered candidates for listing under the Federal Endangered Species Act. Two of these species, Ertter's groundsel (*Senecio ertterae*) and Packard's blazingstar (*Mentzelia packardiae*), grow predominantly on the greenish-yellow ash-tuff talus slopes. Grimy mousetail (*Ivesia rhypara* var. *rhypara*) and Owyhee clover (*Trifolium owyheense*) grow on a shallow, often apricot-colored ash substrate. Barren milkvetch (*Astragalus sterilis*), a rhizomatous form, grows as scattered individuals and colonies on less distinctive ash deposits throughout the region. Three uncommon regional endemics, Packard's wormwood (*Artemisia packardiae*), Mackenzie's phacelia (*Phacelia lutea* var. *mackenzieorum*) and false naked buckwheat (*Eriogonum novonudum*), find habitat in the canyons and bluffs of the ACEC. Oregon lists Packard's blazingstar and barren milkvetch as threatened, and grimy mousetail and Owyhee clover as endangered (Oregon Natural Heritage Program 1998).



Ertter's groundsel (*Senecio ertterae*) is a Malheur County endemic. Photo by Bob Kindschy, BLM Vale District.

Grimy mousetail and Packard's blazingstar are found at disjunct locations in Nevada. However, Ertter's groundsel is a Malheur County endemic, found only in the Leslie Gulch vicinity and at two restricted sites near Birch Creek, a tributary of the Owyhee River approximately six miles southwest of Leslie Gulch. Barren milkvetch and Owyhee clover are endemic to the larger Owyhee region, with the clover known only on sites east of the Owyhee River. Scattered, sparse populations of the clover and milkvetch are found in adjacent Idaho.

With heads of fluorescent pink flowers and three leaflets splashed with distinctive white chevrons, Owyhee clover is the most spectacular of the rare species. Barren milkvetch sports inflated pods mottled with red. Close inspection of the diminutive grimy mousetail's inconspicuous pale flowers is necessary to discern its membership in the rose family. To make their debuts, the two annuals, Packard's blazingstar and Ertter's groundsel, depend on timely rainfall, a commodity which has been in short supply the last few years. Of particular note, the groundsel emerges in late summer or fall and has roots protected by a gelatinous sheath, making it particularly adapted to the loose, cobbly tuffaceous ash.



Owyhee clover (*Trifolium owyheense*) is the most spectacular of the rare species. Photo by Jean Findley.

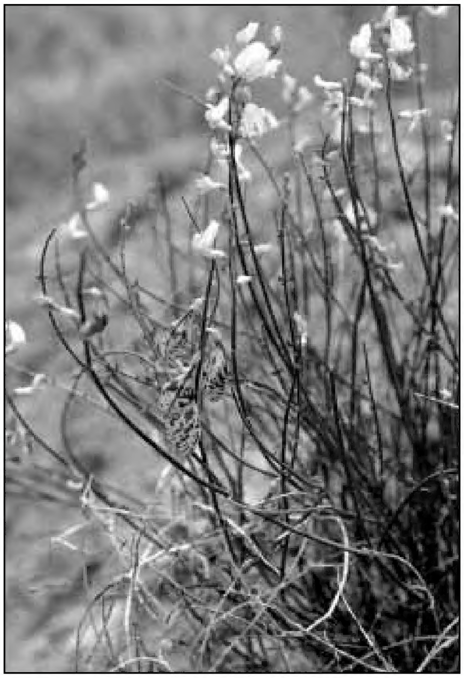
The discovery and naming of these rare species is relatively recent, beginning with Dr. Morton Peck in the early 1940s. Peck was the first to find and name false naked buckwheat. Although he found barren milkvetch at the same time, it was not described until the late 1940s when Dr. Rupert Barneby collected the species in nearby Idaho. Bessie Murphy, a technician at the Oregon State University seed laboratory, visited Malheur County in the late 1940s and took an unusual clover she found back to Helen Gilkey, who then described this new Owyhee species (Gilkey 1956). Dr. Patricia Packard from the College of Idaho and many of her former students, including Dr. Barbara Ertter, Dr. Jim Grimes, Judith Glad, and Dave Peters, combed the area in the late 1960s and early 1970s, finding all the other rare species in the ACEC. They worked with various other botanists to describe the newly discovered groundsel, blazingstar, phacelia, mousetail, and wormwood (Glad 1976, Ertter and Reveal 1977).

Wildlife

Mule deer utilize the ACEC primarily from early winter through early spring. Rocky Mountain elk use varies with the severity of the winter. Upland game birds such as chukar partridge and California quail occupy much of the area. The rugged canyons also provide habitat for coyote, bobcat, cougar, hawks, lizards, and a variety of nongame migratory birds. Raptors, northern flickers, and white-throated swifts nest in the numerous cliff crevices, which also provide habitat for bats.

California bighorn sheep were extirpated from Leslie Gulch in the early 1900s due to infection from domestic sheep diseases and unregulated hunting. Bighorns have thrived in the Gulch since reintroductions in 1965 and 1987. Steep cliffs and small natural shelters along the rock faces provide excellent habitat for bighorn sheep, and the remote, rugged areas extending beyond the ACEC limit human disturbance of the bighorns.

Bald eagles, listed as threatened under the Endangered Species Act, winter along the Owyhee River corridor. Mountain quail, rare in Malheur County for many years, were last observed in the county in 1981, in Leslie Gulch ACEC. Other rare animal species include Townsend's big-eared bat, Mojave black-collared lizard, western ground snake, and white-tailed antelope squirrel.



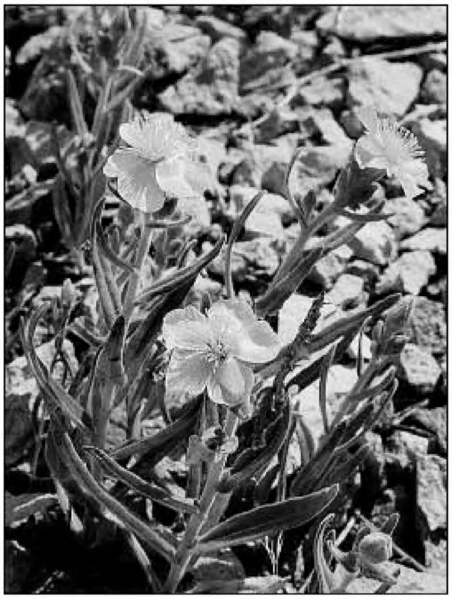
Barren milkvetch (*Astragalus cusickii* var. *sterilis*), a regional endemic, grows on ash deposits. Photo by Elaine Joyal, BLM Vale District.

Management

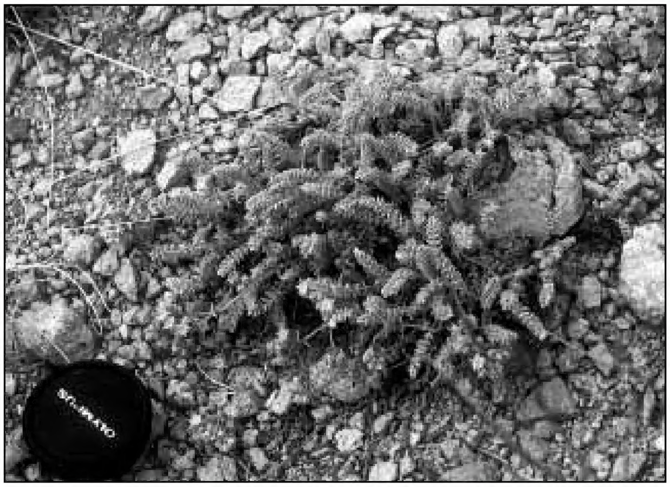
Leslie Gulch has long attracted recreationists in search of a high quality outdoor experience. Elements of its attractiveness are its remote location with reasonable vehicular access and the opportunity to pursue outdoor recreation activities in a setting with relatively few human impacts. A single road through the canyon provides access to one of only five public boat launch sites on the 55 mile long Owyhee Reservoir. Most of the recreational use occurs before and after the hot summer season, specifically the river float season in spring and hunting activities in the fall.

Approximately 85% of the ACEC has been designated as Wilderness Study Area (WSA). The specific wilderness values identified include outstanding opportunities for solitude, primitive and unconfined recreation, a high degree of naturalness, spectacular scenery, rare plants, bighorn sheep, winter habitat for northern bald eagles, Rocky Mountain elk, the disjunct stand of ponderosa pine, and outstanding populations of curlleaf mountain mahogany.

The 1995 ACEC Management Plan strives to retain the area's naturalness through careful regulation of human activities. No off-road vehicle use is permitted, and rock-climbing with permanent anchors is prohibited. Use by livestock has been eliminated from the canyon except for seasonal trailing. Camping is authorized at only one site, the primitive campground at Slocum Creek near the reservoir; the rest of the ACEC is designated as day use only. The ACEC is closed to vegetation gathering, rock hounding, and horse use of any kind. The Leslie Gulch ACEC was officially withdrawn from mineral entry in 1999. Noxious weeds (*Cardaria draba* and *Onopordum acanthium*) have been aggressively treated when found using a variety of control measures, including hand-pulling and spot-spraying.



Look for Packard's blazingstar (*Mentzelia packardiae*) on greenish-yellow ash-tuff talus slopes. Photo by Jean Findley.



Grimy mousetail (*Ivesia rhypara* var. *rhypara*) grows over shallow, apricot-colored ash. Photo by Elaine Joyal, BLM Vale District.

Conclusion

For fantastic rock formations and colorful canyons, Leslie Gulch ACEC is unexcelled in Oregon. The combination of this spectacular geology with an extraordinary variety of vegetative and wildlife resources makes Leslie Gulch a rare jewel of Oregon's natural heritage. Great things truly do come in small packages, especially in Leslie Gulch.

References

Ertter BJ, Reveal JL. 1977. A new species of *Ivesia* (Rosaceae) from southeastern Oregon. Madroño 24:224-227.

Gilkey HM. 1956. A new *Trifolium* from Oregon. Madroño 13:167-199.

Glad JA. 1976. Taxonomy of *Mentzelia mollis* and allied species (Loasaceae). Madroño 23:283-291.

Grimes JW. 1979. The flora of Leslie Gulch, Malheur County, Oregon. Logan (UT): MS Thesis, Utah State University. 54 p.

Grimes JW. 1984. Notes on the flora of Leslie Gulch, Malheur County, Oregon. Madroño 31:80-85.

Kittleman LR. 1973. Guide to the geology of the Owyhee region of Oregon. Eugene (OR): Bull No 21, Museum of Natural History, University of Oregon. 59 p.

McKee A, Knutson D. 1987. A disjunct ponderosa pine stand in southeastern Oregon. Great Basin Naturalist 47:163-167.

[ONHP] Oregon Natural Heritage Program. 1998. Rare, Threatened and Endangered Species of Oregon. Portland (OR): Oregon Natural Heritage Program. 92 p.

Vascular Plant Species List

The following species list for Leslie Gulch ACEC is based on Grimes (1979), with additions by the author, Pat Packard, and Barbara Ertter. Nomenclature follows the Oregon Flora Project checklist. Names of taxa native to Oregon are printed in italic *Garamond*; alien taxa are in italic *Gill Sans*, a sans-serif type.

FERNS AND THEIR ALLIES

DRYOPTERIDACEAE (Wood Fern Family)
Cystopteris fragilis (L.) Bernh. (brittle bladderfern)
Polystichum scopulinum (D.C. Eaton) Maxon (rock swordfern)

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)
Juniperus occidentalis Hook. (western juniper)
PINACEAE (Pine Family)
Pinus ponderosa Douglas ex C. Lawson (ponderosa pine)

DICOTYLEDONS

AIZOACEAE (Fig-Marigold Family)
Mollugo verticillata L. (carpetweed)
ACERACEAE (Maple Family)
Acer glabrum Torr. (Rocky Mountain maple)
AMARANTHACEAE (Amaranth Family)
Amaranthus albus L. (prostrate pigweed)
Amaranthus californicus (Moq.) S. Watson (California amaranth)
APIACEAE (Carrot Family)
Lomatium dissectum (Nutt.) Mathias & Constance (fernleaf biscuitroot)
Lomatium triternatum (Pursh) J.M. Coult. & Rose (nineleaf biscuitroot)
Osmorhiza occidentalis (Nutt.) Torr. (western sweetroot)
Physaria didymocarpa (Hook.) A. Gray (common twinpod)
ASCLEPIADACEAE (Milkweed Family)
Asclepias cryptoceras S. Watson (pallid milkweed)
ASTERACEAE (Sunflower Family)
Achillea millefolium L. (common yarrow)
Agoseris glauca (Pursh) Raf. (pale agoseris)
Antennaria dimorpha (Nutt.) Torr. & A. Gray (low pussytoes)
Antennaria luzuloides Torr. & A. Gray (woodrush pussytoes)
Artemisia arbuscula Nutt. (low sagebrush)
Artemisia dracunculus L. (dragon sagewort)
Artemisia ludoviciana Nutt. (silver wormwood)
Artemisia packardiae J.W. Grimes & Ertter (Packard's wormwood)
Artemisia spinescens D.C. Eaton (bud sagebrush)
Artemisia tridentata Nutt. (big sagebrush)
Aster frondosus (Nutt.) Torr. & A. Gray (alkali aster)
Balsamorhiza sagittata (Pursh) Nutt. (arrowleaf balsamroot)
Blepharipappus scaber Hook. (blepharipappus)
Brickellia microphylla (Nutt.) A. Gray (small leaved brickellia)
Chaenactis douglasii (Hook.) Hook. & Arn. (dustymaidens)
Ericameria nana Nutt. (dwarf heath goldenrod)
Ericameria nauseosa (Pall. ex Pursh) G.L. Nesom & G.I. Baird (rubber rabbitbrush)
Ericameria viscidiflora (Hook.) L.C. Anderson (yellow rabbitbrush)
Cirsium subniveum Rydb. (intermountain thistle)
Crepis acuminata Nutt. (tapertip hawksbeard)
Dimeresia howellii A. Gray (dimersia)
Erigeron bloomeri A. Gray (scabland fleabane)
Erigeron corymbosus Nutt. (foothill daisy)
Erigeron pumilus Nutt. (shaggy fleabane)
Eriophyllum lanatum (Pursh) J. Forbes (common eriophyllum)
Gutierrezia sarothrae (Pursh) Britton & Rusby (broom snakeweed)
Hieracium scouleri Hook. (woolly weed)
Lagophylla ramosissima Nutt. (slender hareleaf)
Machaeranthera canescens (Pursh) A. Gray (hoary aster)
Nothocalais troximoides (A. Gray) Greene (false agoseris)
Onopordum acanthium L. (Scots thistle)
Senecio canus Hook. (woolly groundsel)
Senecio ertterae T.M. Barkley (Ertter's groundsel)
Senecio serra Hook. (butterweed groundsel)
Solidago missouriensis Nutt. (Missouri goldenrod)
Stephanomeria tenuifolia (Raf.) H.M. Hall (narrowleaf stephanomeria)
Tetradymia canescens DC. (gray horsebrush)
Townsendia florifer (Hook.) A. Gray (showy townsendia)
BETULACEAE (Birch Family)
Betula occidentalis Hook. (water birch)
BORAGINACEAE (Borage Family)
Amsinckia lycopsoides Lehm. (tarweed fiddleneck)
Amsinckia tessellata A. Gray (bristly fiddleneck)
Cryptantha intermedia (A. Gray) Greene (common cryptantha)
Lappula redowskii (Hornem.) Greene (western tickweed)
Lithospermum ruderale Douglas ex Lehm. (western gromwell)
Mertensia ciliata (Torr.) G. Don (broad leaved bluebells)
Myosotis micrantha Pall. (blue scorpion grass)
Plagiobothrys scouleri (Hook. & Arn.) I.M. Johnst. (Scouler's popcornflower)
BRASSICACEAE (Mustard Family)
Arabis holboellii Hornem. (Holboell's rockcress)
Barbarea orthoceras Ledeb. (American yellowrocket)

Camelina microcarpa Andrz. ex DC. (littlepod falseflax)
Cardaria draba (L.) Desv. (heart podded hoarycress)
Chorispora tenella (Pall.) DC. (purple field mustard)
Descurainia pinnata (Walter) Britton (western tansymustard)
Draba verna L. (spring whitlow grass)
Erysimum capitatum (Douglas ex Hook.) Greene var. *capitatum* (rough wallflower)
Thelypodium laciniatum (Hook.) Endl. (cutleaf thelypody)
CAPRIFOLIACEAE (Honeysuckle Family)
Sambucus mexicana C. Presl ex DC. (blue elderberry)
Symphoricarpos oreophilus A. Gray (mountain snowberry)
CARYOPHYLLACEAE (Pink Family)
Holosteum umbellatum L. (jagged chickweed)
Minuartia nuttallii (Pax) Briq. ssp. *fragilis* (Maguire & A.H. Holmgren) McNeill (recurved sandwort)
Silene douglasii Hook. (seabluff catchfly)
Silene scaposa B.L. Rob. (Blue Mountain catchfly)
Stellaria calycantha (Ledeb.) Bong. (northern starwort)
Stellaria longipes Goldie (longstalk starwort)
CHENOPODIACEAE (Goosefoot Family)
Atriplex confertifolia (Torr. & Frém.) S. Watson (shadscale saltbush)
Chenopodium leptophyllum (Moq.) S. Watson (narrowleaf goosefoot)
Grayia spinosa (Hook.) Moq. (spiny hopsage)
Sarcobatus vermiculatus (Hook.) Torr. (greasewood)
CORNACEAE (Dogwood Family)
Cornus sericea L. (redosier dogwood)
CROSSOSOMATACEAE (Crossosoma Family)
Glossopetalon spinescens A. Gray var. *aridum* M.E. Jones (spiny green bush)
DIPSACACEAE (Teasel Family)
Dipsacus fullonum L. (common teasel)
FABACEAE (Legume Family)
Astragalus cusickii A. Gray var. *sterilis* (Barneby) Barneby (barren milkvetch)
Astragalus filipes Torr. ex A. Gray (threadstalk milkvetch)
Astragalus lentiginosus Douglas ex Hook. var. *chartaceus* M.E. Jones (freckled milkvetch)
Astragalus purshii Douglas ex Hook. (woollypod milkvetch)
Lathyrus pauciflorus Fernald var. *pauciflorus* (fewflower peavine)
Lupinus arbustus Douglas ex Lindl. (spur lupine)
Lupinus argenteus Pursh var. *heteranthus* (S. Watson) Barneby (tailcup lupine)
Lupinus lepidus Douglas ex Lindl. (dwarf lupine)
Lupinus polyphyllus Lindl. (bigleaf lupine)
Trifolium cyathiferum Lindl. (cup clover)
Trifolium owyheense Gilkey (Owyhee clover)
GENTIANACEAE (Gentian Family)
Frasera albicaulis Douglas ex Griseb. (whitestem frasera)
GERANIACEAE (Geranium family)
Geranium viscosissimum Fisch. & C.A. Mey. ex C.A. Mey. (sticky geranium)
GROSSULARIACEAE (Gooseberry Family)
Ribes aureum Pursh (golden current)
Ribes cereum Douglas (wax current)
HYDROPHLLACEAE (Waterleaf Family)
Hydrophyllum capitatum Douglas ex Benth. (ballhead waterleaf)
Phacelia hastata Douglas ex Lehm. (silverleaf phacelia)
Phacelia linearis (Pursh) Holz. (threadleaf phacelia)
Phacelia lutea (Hook. & Arn.) J.T. Howell var. *mackenzieorum* J.W. Grimes & P.L. Packard (Mackenzie's phacelia)
LAMIACEAE (Mint Family)
Agastache urticifolia (Benth.) Kuntze (nettleleaf giant hyssop)
Mentha canadensis L. var. *canadensis* (L.) Kuntze (wild mint)
Monardella odoratissima Benth. (mountain monardella)
Salvia dorrii (Kellogg) Abrams (purple sage)
LINACEAE (Flax Family)
Linum lewisii Pursh var. *lewisii* (wild blue flax)
LOASACEAE (Loasa Family)
Mentzelia albicaulis (Douglas ex Hook.) Douglas ex Torr. & A. Gray (whitestem blazingstar)
Mentzelia packardiae Glad (Packard's blazingstar)
MALVACEAE (Mallow Family)
Sphaeralcea munroana (Douglas ex Lindl.) Spach ex A. Gray (whitestem globemallow)
ONAGRACEAE (Evening Primrose Family)
Clarkia pulchella Pursh (ragged robin)
Epilobium brachycarpum C. Presl (tall annual willowherb)
Oenothera caespitosa Nutt. (tufted evening-primrose)
PAEONIACEAE (Peony Family)
Paeonia brownii Douglas ex Hook. (western peony)
POLEMONIACEAE (Phlox Family)
Collomia grandiflora Douglas ex Lindl. (grand collomia)
Gilia sinuata Douglas ex Benth. (rosy gilia)
Ipomopsis aggregata (Pursh) V.E. Grant ssp. *aggregata* (skyrocket gilia)
Leptodactylon pungens (Torr.) Nutt. (granite prickly phlox)
Phlox gracilis (Hook.) Greene ssp. *gracilis* (slender phlox)
Phlox hoodii Richardson (woolly phlox)
POLYGONACEAE (Buckwheat Family)
Eriogonum microthecum Nutt. (slender buckwheat)
Eriogonum novonudum M. Peck (false naked buckwheat)
Eriogonum strictum Benth. (Blue Mountain buckwheat)
Eriogonum umbellatum Torr. (sulphur-flower buckwheat)
Eriogonum vimineum Douglas ex Benth. (wickerstem buckwheat)
Polygonum douglasii Greene (Douglas knotweed)
PORTULACACEAE (Purslane Family)
Claytonia perfoliata Donn ex Willd. (miner's lettuce)
Lewisia rediviva Pursh (bitterroot)
RANUNCULACEAE (Buttercup Family)
Aconitum columbianum Nutt. (Columbian monkshood)
Aquilegia formosa Fisch. ex DC. (western columbine)
Clematis ligusticifolia Nutt. (western white clematis)
Delphinium nuttallianum Pritz. ex Walp. (upland larkspur)
Ranunculus glaberrimus Hook. (sagebrush buttercup)
Ranunculus sceleratus L. (blister buttercup)
Ranunculus testiculatus Crantz (hornseed buttercup)
ROSACEAE (Rose Family)
Cercocarpus ledifolius Nutt. ex Torr. & A. Gray (curlleaf mountain mahogany)

Geum triflorum Pursh (old man's whiskers)
Holodiscus dumosus (Nutt. ex Hook.) A. Heller (glandular oceanspray)
Ivesia rhypara Ertter & Reveal var. *rhypara* (grimy mousetail)
Potentilla biennis Greene (biennial cinquefoil)
Potentilla glandulosa Lindl. (sticky cinquefoil)
Potentilla gracilis Douglas ex Hook. (slender cinquefoil)
Prunus virginiana L. (western chokecherry)
Purshia tridentata (Pursh) DC. (antelope bitterbrush)
Rosa woodsii Lindl. (pearhip rose)
RUBIACEAE (Madder Family)
Galium aparine L. (stickywilly)
Galium multiflorum Kellogg (shrubby bedstraw)
SALICACEAE (Willow Family)
Populus tremuloides Michx. (quaking aspen)
Populus trichocarpa Torr. & A. Gray ex Hook. (black cottonwood)
Salix lasiolepis Benth. (arroyo willow)
Salix lucida Muhl. ssp. *lasiandra* (Benth.) E. Murray (Pacific willow)
SAXIFRAGACEAE (Saxifrage Family)
Heuchera cylindrica Douglas ex Hook. (roundleaf alumroot)
Lithophragma parviflorum (Hook.) Nutt. ex Torr. & A. Gray (small flowered fringecup)
SCROPHULARIACEAE (Figwort Family)
Castilleja angustifolia (Nutt.) G. Don (violet desert paintbrush)
Castilleja applegatei Fernald ssp. *martini* (wavyleaf Indian paintbrush)
Castilleja linariifolia Benth. (Wyoming Indian paintbrush)
Castilleja pallescens (A. Gray) Greenm. var. *inverta* (A. Nelson & J.F. Macbr.) Edwin (pale Indian paintbrush)
Castilleja tenuis (A. Heller) T.I. Chuang & Heckard (hairy Indian paintbrush)
Collinsia parviflora Douglas ex Lindl. (small flowered blue eyed Mary)
Mimulus cusickii (Greene) Rattan (Cusick's monkeyflower)
Mimulus nanus Hook. & Arn. (dwarf monkeyflower)
Penstemon deustus Douglas ex Lindl. (hotrock beardtongue)
Penstemon speciosus Douglas ex Lindl. (royal penstemon)
Scrophularia lanceolata Pursh (lanceleaf figwort)
Verbascum thapsus L. (flannel mullein)
Veronica americana Schwein. ex Benth. (American speedwell)
Veronica peregrina L. (purslane speedwell)
SOLANACEAE (Nightshade Family)
Nicotiana attenuata Torr. ex S. Watson (coyote tobacco)
ULMACEAE (Elm Family)
Celtis reticulata Torr. (netleaf hackberry)
URTICACEAE (Nettle Family)
Urtica dioica L. (stinging nettle)
VALERIANACEAE (Valerian Family)
Plectritis macrocera Torr. & A. Gray (longhorn plectritis)
VIOLACEAE (Violet Family)
Viola bakeri Greene (yellow prairie violet)
Viola beckwithii Torr. & A. Gray (Beckwith's violet)

MONOCOTYLEDONS

CYPERACEAE (Sedge Family)
Carex microptera Mack. (smallwing sedge)
Eleocharis palustris (L.) Roem. & Schult. (common spikerush)
JUNCACEAE (Rush Family)
Juncus bufonius L. (toad rush)
Juncus ensifolius Wickstr. (swordleaf rush)
LEMNACEAE (Duckweed Family)
Spirodela polyrrhiza (L.) Schleid. (greater duckweed, duckmeat)
LILIACEAE (Lily Family)
Allium acuminatum Hook. (tapertip onion)
Allium parvum Kellogg (small onion)
Calochortus macrocarpus Douglas (sagebrush mariposa lily)
Fritillaria pudica (Pursh) Spreng. (yellow bells)
Maianthemum racemosum (L.) Link (western Solomon plume)
Maianthemum stellatum (L.) Link (starry false lily of the valley)
Zigadenus paniculatus (Nutt.) S. Watson (foothill deathcamas)
POACEAE (Grass Family)
Achnatherum hymenoides (Roem. & Schult.) Barkworth (Indian ricegrass)
Achnatherum occidentale (Thurb.) Barkworth spp. *occidentale* (western needlegrass)
Agrostis exarata Trin. (spike bentgrass)
Bromus briziformis Fisch. & C.A. Mey. (rattlesnake brome)
Bromus tectorum L. (cheatgrass)
Deschampsia danthonioides (Trin.) Munro (annual hairgrass)
Deschampsia elongata (Hook.) Munro (slender hairgrass)
Elymus glaucus Buckley (blue wildrye)
Elymus trachycaulus (Link) Gould ex Shinners ssp. *trachycaulus* (slender wheatgrass)
Festuca idahoensis Elmer (Idaho fescue)
Hordeum brachyantherum Nevski (meadow barley)
Hordeum jubatum L. (foxtail barley)
Leymus cinereus (Scribn. & Merr.) A. Löve (basin wildrye)
Melica spectabilis Scribn. (purple oniongrass)
Poa secunda J. Presl (Sandberg bluegrass)
Pseudoroegneria spicata (Pursh) A. Löve (bluebunch wheatgrass)
Sporobolus cryptandrus (Torr.) A. Gray (sand dropseed)
Vulpia octoflora (Walter) Rydb. (sixweeks fescue)

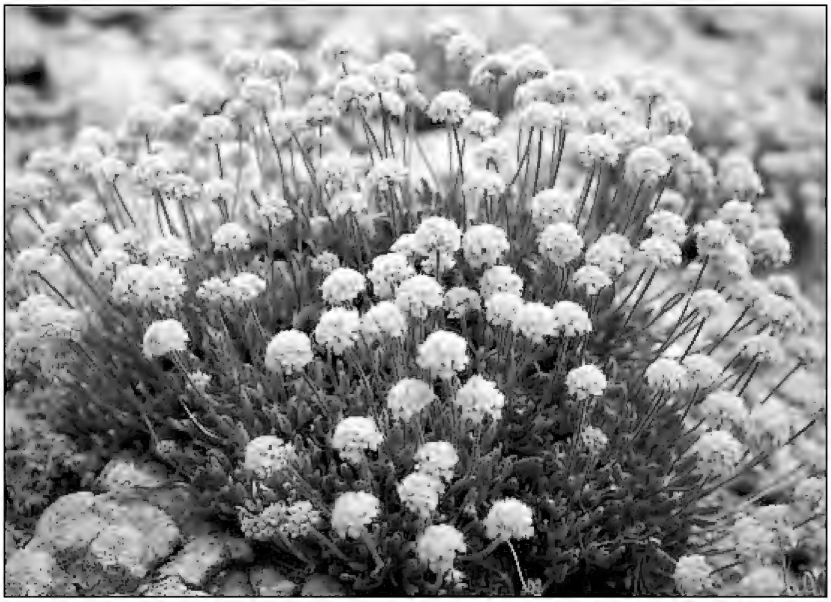
Jean Findley has been a botanist on the Vale District BLM, Oregon, for 16 years, following 11 years as a range conservationist on the same district. She obtained an MS degree in Rangeland Resources from Oregon State University with a thesis having a botany focus. She furthered her botanical training with Dr. Patricia Packard at Albertson College of Idaho.

Guano Creek/Sink Lakes

Lucile A. Housley
Lakeview District BLM, 1301 South G Street, Lakeview, Oregon 97630

> *As I traveled through the remote sagebrush covered hills in southern Lake County, I spotted barren light colored hills off in the distance. I turned my pickup toward the hills, knowing they could harbor some interesting plants. Approaching the hills, I could see they were covered with pin cushion-like plants ablaze in yellow flowers. Grabbing a hand lens, camera, and trowel I headed off to see what they were. As I sat on the ground examining the plants, I knew this was an* Eriogonum *I had never seen before.* –Virginia Crosby Pyles

Thus, over twenty-five years ago, Lakeview BLM botanist Virginia Crosby discovered a new species of buckwheat in the southern part of Guano Valley. It was described in 1978 and named *Eriogonum crosbyae* (Reveal 1981). Crosby's buckwheat is limited to southwestern Harney County and southeastern Lake County, Oregon, and Washoe County in northwestern Nevada. Like several other rare buckwheats in Lake County, Crosby's buckwheat is restricted to white tuffaceous ash flow soils that are stratified with rhyolite. Although there is little competition from other plants in this environment, plants must survive the rigors of intense sun without a protective canopy, nutrient-poor soil, frost heaving, and soil movement (Kaye and others 1990). In addition to Guano Creek/Sink Lakes RNA, this low, woody, matted buckwheat grows near Fish Fin Rim (23 miles northeast), and on Oregon State land that lies south of Highway 140. However, the RNA is one of the best sites to study this buckwheat and its habitat; particularly, at the end of a closed jeep trail one mile west of the valley floor where bright yellow balls of yellow flowers over gray-green cushions of buckwheat stand out on the white hillsides.



Pin cushion-like Crosby's buckwheat (*Eriogonum crosbyae*) ablaze with yellow flowers. Photo by Steve Shelly.

Guano Creek/Sink Lakes RNA/ACEC

Guano Valley is a large north-south trending Pleistocene pluvial lake bed 20 miles east of Adel in southeastern Lake County. If you follow a dirt road (BLM 6106-0-0A) north of Highway 140 for twelve miles, you arrive at the uninhabited Shirk Ranch. Once a local bustling center, the ranch was abandoned 20 years ago, and now the area and structures have been nominated for the National Register of Historic Places. A mile north of the ranch, Guano Creek flows into the valley from a canyon to the west. With headwaters at Blue Sky on Hart Mountain, Guano Creek, an intermittent desert water course, carved Guano Canyon through the basalt layers below the dam at Jacob's Reservoir, winding six miles through lava banks and white pumice hills to reach the broad, open Guano Valley. The hill on the north side of the creek rises to a high plateau where three vernal pools lie among the bunch grasses and sagebrush. The area that surrounds Guano Creek, including the uplands (Sink Lakes), was declared a Research Natural Area /Area of Critical Environmental Concern (RNA/ACEC) in November 2003 (USDI-BLM 2003a). (All RNAs in the BLM are managed as ACECs.) The Guano Creek/Sink Lakes RNA/ACEC encompasses 11,199 acres and includes all of the Guano Creek Wilderness Study Area (T38S R26E; T38S R27E). Hart Mountain National Antelope Refuge abuts the northern boundary of the ACEC. Some of the reasons for designating this RNA/ACEC were to protect three sensitive plant species and Oregon Natural Heritage Program ecosystem "cells" of biological diversity (BLM 1988).

Rare Plants

On the west-facing cliffs above Guano Creek, near the Crosby's buckwheat habitat, but on a slightly different substrate, grows another rare plant, *Eriogonum prociduum*, prostrate buckwheat. Both buckwheats are BLM sensitive species and on Oregon Natural Heritage Program (ONHP) List 1 (threatened or endangered throughout range).

In 1988, BLM botanists Ginger King and Steve Shelly and volunteer Elaine Reese discovered grimy ivesia (*Ivesia rhypara* var. *rhypara*) while hiking up a steep hillside of vitric ash flow pumice

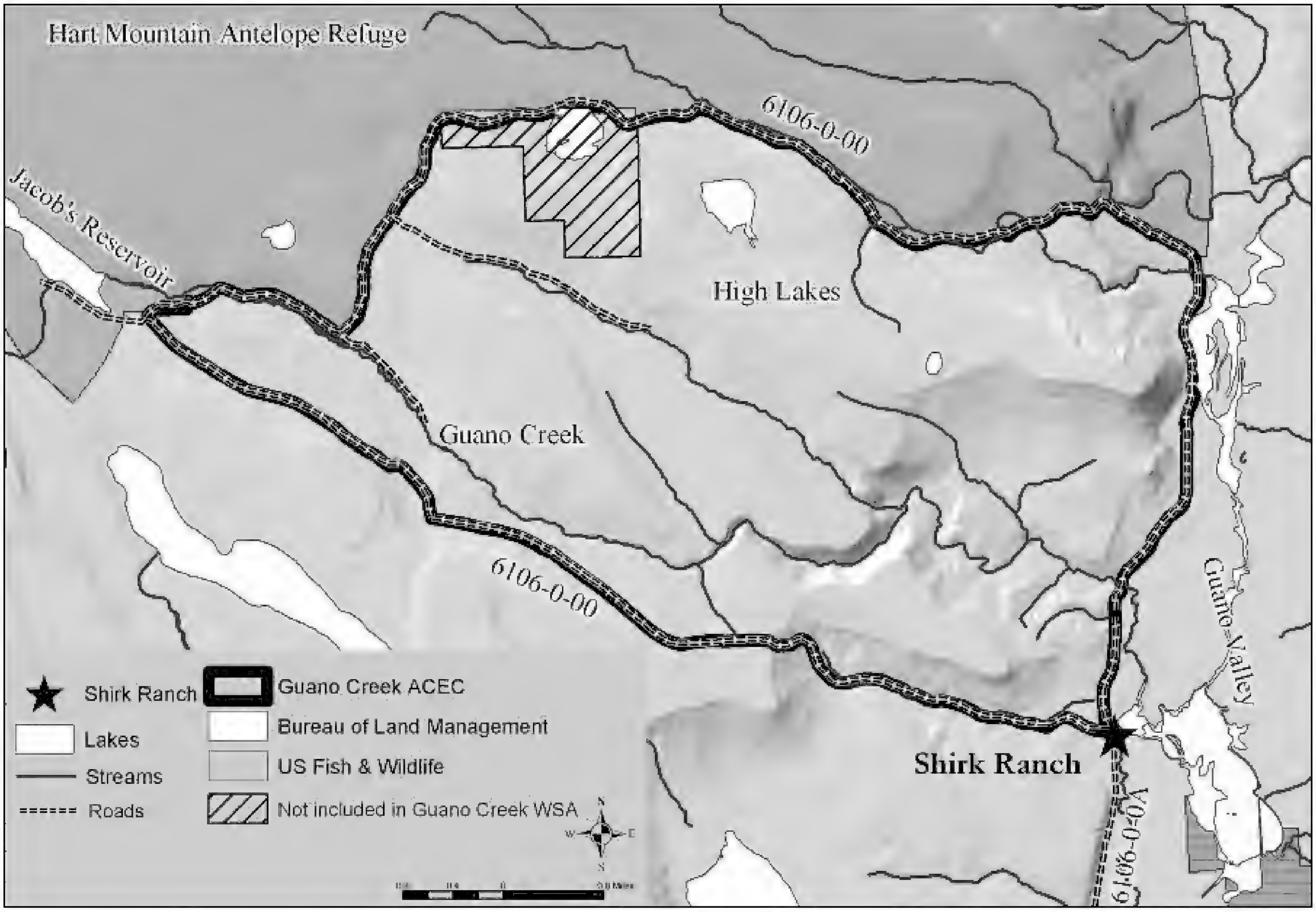
Crosby's buckwheat is restricted to white tuffaceous ash flow soils that are stratified with rhyolite. Photo by Ginger King.

near the Crosby's buckwheat site. A tiny cushion-shaped member of the rose family, its small flowers are white petals on a yellow "cup." It grows in four long shallow cracks that cross the ash flow hillside. The only other population of grimy ivesia in Oregon is in Malheur County (see article about Leslie Gulch on page 3). Disjunct populations occur in Washoe and Elko counties, Nevada (Kaye and others 1991). Grimy ivesia is a BLM Bureau sensitive species and on ONHP List 1. The Guano Creek area was closed to grazing in 1994, when livestock trampling reduced the ivesia to 28 individuals. Annual monitoring during the past nine years has shown that the population has remained relatively stable, probably because the species is a long-lived perennial. Threats that could slowly decimate the population are the possibility of climate warming and diminished variability due to a small gene pool. Although nothing can be done about either factor, the health of the population continues to be monitored. Nevada mining projects have threatened *Ivesia* populations; however, because of the WSA nomination and RNA creation, mining does not pose a threat at Guano Creek (BLM 2000).

Plant Communities

Guano Creek/Sink Lakes RNA is in the Northern Basin and Range Ecoregion (Allen and others 2001). The bright green riparian canyon bottom contrasts sharply with gray-green sagebrush/bunchgrass hillsides and outcrops of strange ash formations, dark basalt cliffs and white pumice. The Oregon Natural Heritage Program designated the following three cells: riparian willow, silver sagebrush/basin wildrye, and big sagebrush/Idaho fescue. In addition to these three cells in the Guano Creek portion, two more are represented in the Sink Lakes area (see below).

In addition to the rare *Ivesia* and *Eriogonum* species, the canyon is worth visiting for its rich displays of wildflowers in late May and early June. Scattered juniper (*Juniperus occidentalis*) grace the hillsides. Blue camas (*Camassia quamash*), white yampah



Guano Creek/Sink Lakes RNA/ACEC. Map prepared by Shannon Theall.

(*Perideridia* spp.), wild iris (*Iris missouriensis*), various sedges, silver sagebrush (*Artemisia cana*), and basin wildrye (*Leymus cinereus*) grow on the valley floor with fringed water-plantain (*Damasonium californicum*) in the flowing stream; all contribute to the rich diversity of the plant community. Several species were used by Native Americans in the past and are "cultural plants" protected under Tribal Trust Responsibilities (Forest Service and BLM 1995). These plants are indicated in the species list by #.

Guano Creek winds six miles through lava banks and white pumice hills to reach the broad, open Guano Valley. Photo by Lucile Housley.

Willows (*Salix exigua, S. lasiolepis, S. lucida*) border the lower reaches of the creek, but the upper tributary is too harsh and rocky for willows. The striking white pumice hills support a distinctive vegetation. OHNP has nominated these ash flow soil plant communities for designation as a unique "cell" for study in southeastern Oregon. Some of the plants found on the ash flows are ball-headed gilia (*Gilia congesta*), prickly phlox (*Leptodactylon pungens*), Watson's white forget-me-not (*Crypthantha watsonii*), Hood's phlox (*Phlox hoodii*), dwarf skullcap (*Scutellaria nana*), fennel-leaved lomatium (*Lomatium foeniculaceum* var. *macdougalii)*, and desert paintbrush (*Castilleja chromosa*). Surrounding the ash hills, the vegetation is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis)*, two different rabbitbrushes (*Ericameria nauseosa, E. viscidiflora*), other buckwheats (*Eriogonum ovalifolium*, *E. caespitosum),* and evening primrose (*Oenothera cespitosa*). Higher on the hillside, Wyoming big sagebrush mixes with dense stands of Idaho fescue (*Festuca idahoensis*), needle-and-thread *(Hesperostipa comata*) and Indian ricegrass *(Achnatherum hymenoides*).

The northern half of the RNA is called "the Sink Lakes" for three seasonal lakes (vernal pools) lying on a large, treeless, flat plateau of low sagebrush (*Artemisia arbuscula*), forbs, and bunchgrasses. In 2000, Billy Burr Lake and surrounding area was granted to the BLM by The Nature Conservancy. The two ONHP "cells" in this part of the RNA are low sagebrush/Sandberg bluegrass scabland and low elevation vernal ponds.

Monitoring studies indicate that the health and diversity of vernal pool plant communities have improved since grazing was discontinued; the dryland area will be slower to demonstrate vegetative change. Silver sagebrush rings the vernal pools, which are surrounded by slightly rolling uplands dominated by low sagebrush grasslands. The dry lakebeds differ in their vegetative composition, but all may be dominated by tansyleaf evening primrose (*Camissonia tanacetifolia*). The middle lake is best characterized as a silver sagebrush/Nevada bluegrass plant community. Baltic rush (*Juncus balticus*) and leafy arnica (*Arnica chamissonis*) fill the lakes in wet years. Povertyweed (*Iva axillaris*) and lanceleaf goldenweed (*Pyrrocoma lanceolata*) dominate the lake beds when they dry out. Other grass species present in the dried pools are mat muhly (*Muhlenbergia richardsonis*) and water foxtail (*Alopecurus geniculatus*) (BLM 2003a).

Low sagebrush grasslands dominate the surrounding uplands, which also display a variety of wild flowers in May and June. The grasses include Sandberg's bluegrass *(Poa secunda*), Wheeler's bluegrass (*Poa nervosa*), bottlebrush squirreltail (*Elymus elymoides)* and Thurber's needlegrass (*Achnatherum thurberianum*). There are small stands of Wyoming big sagebrush, rock currant (*Ribes cereum*), chokecherry (*Prunus virginiana*), aspen (*Populus tremuloides*), and mountain mahogany (*Cercocarpus ledifolius*).

Climate, Geology and Soils

Elevation within the RNA ranges from 5,300 to 5,980 feet. The climate is arid, with average precipitation less than ten inches per year, falling mainly as snow in the winter (January) and rain in spring (May). The geology of the RNA is spectacular; the lower reaches of Guano Creek cut through Tertiary-age tuffaceous and pumiceous sedimentary rock and locally welded tuffs. Faulting in

Grimy ivesia (*Ivesia rhypara* var. *rhypara*) grows on a steep hillside of vitric ash flow pumice. Photo by Ginger King.

The small flowers of grimy ivesia reveal that it is a member of the rose family. Photo by Ginger King.

the area largely controls the course of Guano Creek. The Sink Lakes lie on Tertiary-age basalt flows dissected by the Eugene-Denio lineament. In this area, numerous normal and reverse faults create a series of northwest-southeast trending grabens that contain intermittent lakes. These graben lakes are characterized by Quaternary-age clayey, silty, and in some cases, sandy playa deposits. Tertiary tuffaceous sedimentary rocks along the eastern portion of the RNA contain late Miocene vertebrate fossils, which may be viewed, but not collected (BLM 1989).

Wildlife

Guano Creek/Sink Lakes provide season-long habitat for mule deer and pronghorn antelope. Bighorn sheep can occasionally be seen on the rims. Another inhabitant of the RNA, northern sage grouse, is a candidate species for Federal threatened and endangered status. Wintering concentrations are high, and there is at least one strutting ground (lek) within the area. Although no known raptor nest sites lie within the RNA boundary, one golden eagle and two prairie falcon nests occur within six miles. Guano Creek is the habitat for Sheldon tui chub, a Federal Species of Concern, State Candidate, and ONHP List 1. Its range is limited to a few springs and streams in northwest Nevada and southeast Oregon. Waterfowl, including gadwalls, pintails, shovelers, mallards, and Canada geese, nest among the emergent vegetation of Sink Lakes and Guano Creek during wet years. These same areas provide resting and feeding habitat for these and other migrating birds each spring. The RNA contains habitat for pygmy rabbit, coyote, skunk, badger, porcupine, weasel, numerous birds, small mammals, amphibians, Western rattlesnakes, gopher snakes, fence lizards, and other reptiles (Forest Service and BLM 1989, BLM 1988).

The bright green riparian canyon bottom of Guano Creek contrasts sharply with gray-green sagebrush/bunchgrass hillsides. Photo by Lucile Housley.

Human History

Although a thorough inventory of all cultural resources within the Guano Creek/Sink Lakes area has not been completed, surveys for project work have uncovered some sites, including lithic scatters of obsidian flakes, stone rings, and rock art. During the 10,000 years that Native Americans have been visiting this area, their activities may have included stone quarry work, occupation while collecting plants and hunting, and rock art which could be of a religious nature (BLM 1988). Guano Creek may have provided a travel corridor between hunting/gathering at lower elevations and activities higher on the plateau and Hart Mountain.

In the historic past, the entire area was grazed by cattle and sheep. Partly because there is no grazing of livestock at the present time, few people travel through or to this area of the Lakeview District. In the spring, the RNA is worth visiting for its "rock garden" wild flowers; while in the fall, hunters utilize the area.

Management

The Wilderness Study Area (WSA) complicates management decisions. However, the following decisions have been made for the present: new rights-of-way will be excluded, and off highway vehicles (OHVs) will be limited to designated roads and trails, even if the area is released from wilderness study. Due to its WSA status, the area will be managed as Visual Resource Management (VRM) Class I, which preserves the existing character of the landscape. This class limits management activity, allowing only natural ecological changes. If the area is released from wilderness study, it will be managed as VRM Class III, which is to partially retain the existing character of the landscape. Regardless of the fate of the wilderness proposal, the area will remain closed to grazing, as described in a recent plan amendment and the Oregon Public Lands Transfer and Protection Act of 1998. Commercial and personal plant collecting will be limited; research permits may be available at the Lakeview BLM office. Due to WSA status, the area is closed to mineral disposal and leasing; this will remain the same under RNA strictures, even if the area is released from WSA status. Mineral location within the WSA will be subject to the no reclamation requirement of the wilderness Interim Management Plan. If released from wilderness study, the WSA will be open to all mineral location, subject to the preparation of a plan of operations (BLM 2003b). During the WSA process, Guano Creek WSA was recommended as "suitable" for wilderness designation; however, it awaits Congressional approval for the finalization of the process (BLM 1989).

Research

Research projects within the RNA have centered around grimy ivesia and Crosby's buckwheat, including monitoring, pollination, genetics, electrophoresis, and seed viability studies (Kaye and others 1990, 1991). Monitoring will continue and a Conservation Agreement for the ivesia and the two buckwheats has been recommended. The BLM and The Nature Conservancy have conducted vegetative plot studies to determine changes in plant cover, especially in the areas of the vernal pools. Future research could include studies of invertebrates of the vernal pools, comparison of this *Ivesia* population to the closest population on the Sheldon National Wildlife Refuge (45 miles to the southeast) and studies of the hydrology and effects to the creek due to altered hydrologic/sediment transport regime relating to Jacob's Reservoir. The Guano Creek riparian area and canyon is a classic example of connectivity between the lower lands of Guano Valley and the uplands of Hart Mountain (D. Dobkin, pers. comm.). Blue camas occurs at Blue Sky on Hart Mountain and follows the riparian zone of Guano Creek through an area where lilies would not otherwise occur to the east end of Guano Canyon. No one has looked at the connectivity of other species of plants, insects, birds or animals along this corridor in a "desert" environment.

Low sagebrush grasslands on the surrounding uplands display a variety of wild flowers in May and June. Photo by Lucile Housley.

Recreational Opportunities

While it takes a concerted effort to visit this RNA located 67 miles northeast of Lakeview, a description of the area in the Oregon Wilderness Environmental Impact Statement (BLM 1989) entices visitors. Opportunities for solitude exist throughout the RNA. Native plant communities and rare plant and animal species enhance the already outstanding primitive, unconfined recreational opportunities, such as day hiking, wildlife viewing, photography, horseback riding, and hunting for deer or antelope. Day hiking routes vary from easy (strolling the flat terrain at the top of the plateau) to difficult (scaling the steep, rugged terrain in the canyon and rims). Visitors can easily isolate themselves in the canyon and along the rimrock, where the landform and junipers offer screening. The bowl-like depressions that form the sink lakes in the basalt uplands offer isolation in spite of the low vegetation. The remoteness of the RNA elicits a feeling of solitude even on the open sage flats.

Visiting Guano Creek/Sink Lakes

The boundary road (6106-0-00) circles the entire RNA and there are two short routes that enter the area from the west. The Sink Lakes section of the RNA can be reached by four-wheel drive three miles north of Shirk Ranch via the jeep trail west on the boundary between Hart Mountain and the RNA. This rough trail winds up through scattered junipers and in some places, over lava slabs. Or, one can travel west from Shirk Ranch on the dirt road (BLM 6106-0-00) a little over six miles to Jacob's Reservoir. Before arriving at the reservoir, take the jeep trail that goes to the north across Guano Creek and up onto the plateau, where the two roads meet near Billy Burr Lake. All of the RNA is accessible by hiking or horseback.

Acknowledgments

David S. Dobkin, director of the High Desert Ecological Research Institute in Bend, provided information concerning research on biological connectivity between highland and lowland areas. Virginia Crosby Pyles shared her experience discovering *Eriogonum crosbyae*. She still works for the BLM, in Denver, Colorado. Other contributors to the species list, in addition to V. Crosby, include Steve Shelly, botanist and State RNA director, USFS in Montana; Kim Frymire, botanist Umatilla USFS; Ginger King Milota, former BLM botanist; Elaine Reese, former BLM volunteer; and Reid Schuller, botanist and Executive Director of Natural Areas Association, Bend, Oregon.

References

Allen S, Buckley AR, Meacham JE. 2001. Atlas of Oregon. 2nd ed. Eugene (OR): University of Oregon Press. 301 p.

Kaye T, Messinger W, Massey S. 1990. *Eriogonum crosbyae* and *E. prociduum* Inventory, Reproduction, and Taxonomic Assessment. Challenge-Cost Share: BLM and Oregon Dept Agric, Proj No 89-6. 48 p.

Kaye T, Meinke R, Kephart S, Mellor J. 1991. Systematic Study, Monitoring Program, and Inventory of *Ivesia rhypara*. Challenge Cost Share Project: BLM and Oregon Dept Agric, Plant Conservation Biol Prog, Proj No 90-4. 33 p.

[ONHP] Oregon Natural Heritage Program. 2001. Rare, Threatened and Endangered Species of Oregon. Portland (OR): Oregon Natural Heritage Program. 98 p.

Reveal JL. 1981. Notes on endangered buckwheats (*Eriogonum*: Polygonaceae) with three newly described from the western United States. Brittonia 33:441-448.

[USDA FS and USDI BLM] Forest Service and Bureau of Land

Management. 1995. Treaties, Spirituality, and Ecosystems-American Indian Interests in the Northern Intermontane Region of Western North America. Boise (ID): Social Assessment Report for Interior Columbia Basin Final EIS. Interior Columbia Basin Ecosystem Management Project, Science Integration Team.

[USDI BLM] Bureau of Land Management. 1988. 1613 -Areas of Critical Environmental Concern. Washington (DC): Resource Management Planning Guidance. 22 p.

[USDI BLM] Bureau of Land Management. 1989. Oregon Wilderness Final Environmental Impact Statement. Vol II. Portland (OR): Oregon/Washington State Office.

[USDI BLM] Bureau of Land Management. 2000. Areas of Critical Environmental Concern Nomination Analysis Report for Lakeview Resource Area, Resource Management Plan. 57 p.

[USDI BLM] Bureau of Land Management. 2003a. Draft Lakeview Resource Management Plan/Environmental Impact Statement, Lakeview Resource Area, Lakeview District, Lakeview, OR. 3 volumes.

[USDI BLM] Bureau of Land Management. 2003b. Lakeview Resource Management Plan and Record of Decision. 1 volume.

Vascular Plant Species List

The following species list for Guano Creek/Sink Lakes RNA/ACEC was compiled by Lucile Housley. Nomenclature follows the Oregon Flora Project checklist. Names of taxa native to Oregon are printed in italic *Garamond*; alien taxa are in italic *Gill Sans*, a sans-serif type. An asterisk (*) indicates Bureau of Land Management Special Status Plant Species. Names followed by a pound sign (#) are cultural plants, used by Tribal people.

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)

Juniperus occidentalis Hook. (western juniper)#

DICOTYLEDONS

APIACEAE (Carrot Family)

Lomatium foeniculaceum (Nutt.) J.M. Coult. & Rose var. *macdougalii* (J.M. Coult. & Rose) Cronquist (fennel leaved lomatium)#
Lomatium macrocarpum (Nutt.) J.M. Coult. & Rose (large fruited lomatium)#
Lomatium nudicaule (Pursh) J.M. Coult. & Rose (naked desert parsley)#
Perideridia bolanderi (A. Gray) A. Nelson & J.F. Macbr. (Bolander's yampa)#

ASTERACEAE (Sunflower Family)

Achillea millefolium L. (common yarrow)
Agoseris heterophylla (Nutt.) Greene (annual agoseris)
Antennaria dimorpha (Nutt.) Torr. & A. Gray (low pussytoes)
Arnica chamissonis Less. (meadow arnica)
Artemisia cana Pursh (silver sagebrush)
Artemisia arbuscula Nutt. (low sagebrush)#
Artemisia tridentata Nutt. ssp. *wyomingensis* Beetle & A. Young (Wyoming big sagebrush)#
Aster scopulorum A. Gray (crag aster)
Balsamorhiza sagittata (Pursh) Nutt. (arrowleaf balsamroot)#
Balsamorhiza serrata A. Nelson & J.F. Macbr. (toothed balsamroot)#
Blepharipappus scaber Hook. (eye-lash plant)
Chaenactis douglasii (Hook.) Hook. & Arn. (dustymaidens)
Crepis acuminata Nutt. (tapertip hawksbeard)
Ericameria nauseosa (Pall. ex Pursh) G.L. Nesom & G.I. Baird (gray rabbitbrush)
Ericameria viscidiflora (Hook.) L.C. Anderson (green rabbitbrush)
Erigeron linearis (Hook.) Piper (lineleaf fleabane)
Eriophyllum lanatum (Pursh) J. Forbes (Oregon sunshine)
Iva axillaris Pursh (povertyweed)
Pyrrocoma lanceolata (Hook.) Greene (lanceleaf goldenweed)
Senecio integerrimus Nutt. (western groundsel)
Taraxacum officinale Weber ex F.H. Wigg. (common dandelion)

BORAGINACEAE (Borage Family)

Cryptantha celosioides (Eastw.) Payson (cockscomb cryptantha)
Cryptantha watsonii (A. Gray) Greene (Watson's catseye)
Mertensia ciliata (Torr.) G. Don (streamside bluebells)
Plagiobothrys scouleri (Hook. & Arn.) I.M. Johnst. (Scouler's popcorn flower)

BRASSICACEAE (Mustard Family)

Arabis holboellii Hornem. (Holboell's rock cress)
Cusickiella douglasii (A. Gray) Rollins (Douglas draba)
Phoenicaulus cheiranthoides Nutt. ex Torr. & A. Gray (daggerpod)

CAMPANULACEAE (Bellflower Family)

Downingia elegans (Douglas ex Lindl.) Torr. (elegant downingia)

CAPRIFOLIACEAE (Honeysuckle Family)

Sambucus mexicana C. Presl ex DC. (blue elderberry)#

CARYOPHYLLACEAE (Pink Family)

Arenaria aculeata S. Watson (prickly sandwort)

FABACEAE (Legume Family)

Astragalus filipes Torr. ex A. Gray (threadstalk milkvetch)
Astragalus malacus A. Gray (shaggy milkvetch)
Astragalus obscurus S. Watson (arcane milkvetch)
**Astragalus tetrapterus* A. Gray (four winged milkvetch)
Lupinus uncialis S. Watson (inch high lupine)

GENTIANACEAE (Gentian Family)

Frasera albicaulis Douglas ex Griseb. (whitestem frasera)

GROSSULARIACEAE (Gooseberry Family)

Ribes aureum Pursh (golden currant)#
Ribes cereum Douglas (rock currant)#

HYDROPHYLLACEAE (Waterleaf Family)

Hesperochiron californicus (Benth.) S. Watson (false strawberry)
Phacelia hastata Douglas ex Lehm. (silverleaf phacelia)
Phacelia linearis (Pursh) Holz. (threadleaf phacelia)
Phacelia lutea (Hook. & Arn.) J.T. Howell (yellow phacelia)

LABIATAE (Mint Family)

Monardella odoratissima Benth. (mountain monarda)#

ONAGRACEAE (Evening Primrose Family)

Camissonia tanacetifolia (Torr. & A. Gray) P.H. Raven (tansyleaf evening primrose)
Oenothera cespitosa Nutt. (tufted evening primrose)#

OROBANCHACEAE (Broom-rape Family)

Orobanche uniflora L. (single flower broomrape)#

PAPAVERACEAE (Poppy Family)

Canbya aurea S. Watson (golden canbya, yellow pygmy-poppy)

POLEMONIACEAE (Phlox Family)

Collomia grandiflora Douglas ex Lindl. (large flowered collomia)
Ipomopsis congesta (Hook.) V.E. Grant (ballhead gilia)

Leptodactylon pungens (Torr.) Nutt. (prickly phlox)
Navarretia intertexta (Benth.) Hook. (needleleaf navarretia)
Phlox hoodii Rich. (woolly phlox)
Phlox longiflora Nutt. (longleaf phlox)
POLYGONACEAE (Buckwheat Family)
Eriogonum cespitosum Nutt. (mat buckwheat)
**Eriogonum crosbyae* Reveal (Crosby's buckwheat)
Eriogonum ovalifolium Nutt. (cushion buckwheat)
**Eriogonum prociduum* Reveal (prostrate buckwheat)
Eriogonum strictum Benth. (Blue Mountain buckwheat)
PORTULACACEAE (Purslane Family)
Lewisia rediviva Pursh (bitterroot)#
PRIMULACEAE (Primrose Family)
Dodecatheon conjugens Greene (desert shooting star)
RANUNCULACEAE (Buttercup Family)
Delphinium andersonii A. Gray (desert larkspur)
Ranunculus glaberrimus Hook. (sagebrush buttercup)
Ranunculus occidentalis Nutt. (western buttercup)
ROSACEAE (Rose Family)
Cercocarpus ledifolius Nutt. ex Torr. & A. Gray (curlleaf mountain mahogany)#
Geum triflorum Pursh (prairie smoke, old man's whiskers)
**Ivesia rhypara* Ertter & Reveal var. *rhypara* (grimy ivesia)
Potentilla anserina L. (common silverweed)#
Prunus virginiana L. (chokecherry)#
SALICACEAE (Willow Family)
Populus tremuloides Michx. (quaking aspen)
Salix exigua Nutt. (coyote willow)#
Salix lasiolepis Benth. (arroyo willow)#
Salix lucida Muhl. (shining willow)#
SAXIFRAGACEAE (Saxifrage Family)
Lithophragma glabrum Nutt. (smooth fringecup)
SCROPHULARIACEAE (Figwort Family)
Castilleja angustifolia (Nutt.) G. Don var. *dubia* A. Nelson (desert paintbrush)
Castilleja pilosa (S. Watson) Rydb. (hairy paintbrush)
Mimulus nanus Hook. & Arn. (purple monkeyflower)
Penstemon humilis Nutt. ex A. Gray (lowly penstemon)
Penstemon speciosus Douglas ex Lindl. (showy penstemon)
VIOLACEAE (Violet Family)
Viola beckwithii Torr. & A. Gray (Beckwith's violet)

MONOCOTYLEDONS

ALISMATACEAE (Water-plantain Family)
Damasonium californicum Torr. (fringed water plantain)
CYPERACEAE (Sedge Family)
Eleocharis acicularis (L.) Roem. & Schult. var. *bella* Piper (delicate spike rush)#
Eleocharis palustris (L.) Roem. & Schult. (common spike rush)#
IRIDACEAE (Iris Family)
Iris missouriensis Nutt. (western iris)
JUNCACEAE (Rush Family)
Juncus balticus Willd. (Baltic rush)#
LILIACEAE (Lily Family)
Allium acuminatum Hook. (tapertip onion)#
Camassia quamash (Pursh) Greene (blue camas)#
Leucocrinum montanum Nutt. (sand lily)
POACEAE (Grass Family)#
Achnatherum hymenoides (Roem. & Schult.) Barkworth (Indian ricegrass)
Achnatherum thurberianum (Piper) Barkworth (Thurber's needlegrass)
Alopecurus geniculatus L. (water foxtail)
Bromus tectorum L. (cheatgrass)
Elymus elymoides (Raf.) Swezey (bottlebrush squirreltail)
Festuca idahoensis Elmer (Idaho fescue)
Hesperostipa comata (Trin. & Rupr.) Barkworth (needle and thread grass)
Koeleria macrantha (Ledeb.) Schult. (junegrass)
Leymus cinereus (Scribn. & Merr.) A. Löve (basin wildrye)
Muhlenbergia richardsonis (Trin.) Rydb. (mat muhly)
Poa secunda J. Presl (Nevada bluegrass)
Poa wheeleri Vasey (Wheeler's bluegrass)
Pseudoroegneria spicata (Pursh) A. Löve (bluebunch wheatgrass)

Lucile A. Housley has worked for the BLM as the area botanist in the Lakeview Resource Area (RA) for ten years. Among her many duties, she manages and coordinates the RNA/ACECs in the Resource Area. For the last four years, the Lakeview RA has been working on a new Resource Management Plan; and the designation of new RNA/ACECs and evaluating existing RNA/ACECs was her particular task, as well as Bureau Special Status plant species and cultural plants. With the signing of the Record of Decision, 15 ACECs now exist in the Lakeview Resource Area, 10 of which contain designated RNAs. She is a member of the Klamath Basin Chapter of NPSO. Before working for the BLM, Lucile was the Executive Director of Malheur Field Station in Harney County, a research station for 22 colleges and universities in the Northwest. Lucile received her BA in botany and plant ecology from Pomona College and her MA from Rancho Santa Ana Botanic Gardens in Claremont, California. For the past 35 years she has worked with Tribal members in the field of ethnobotany, carrying out research with the Pueblo peoples of New Mexico, the indigenous herbalists in Chile, and most recently with various tribes in the Northern Intermountain Region and Northern Great Basin.

Foster Flat

Nora Taylor
Burns District BLM, 28910 Highway 20 West, Hines, OR 97738

The road to Foster Flat. Looking north about 10 miles from Highway 205, western juniper covers Jackass Butte in the background. Wyoming big sagebrush dominates the flats in the foreground. Photo by Mark Armstrong.

As you travel south from Burns along State Route 205, your attention is captured by the Malheur National Wildlife Refuge along the left side of the highway and the dominating bulk of Steens Mountain on the horizon ahead. It's easy to miss the small green sign along the side of the road just past milepost 38 announcing "Foster Flat - 32 miles." Looking down the dirt road to the west, the view is sagebrush flats and juniper-covered hills. Thirty-two miles. That's a long way off the paved road, but the trip is worth it for the desert rat or the curious botanist. When you reach your destination, you find a subtle gem. Subtle, because the features that make this area so valuable are not instantly obvious. Many Research Natural Areas (RNAs) are designated for diverse vegetation, rare plants, or great elevation differences. Foster Flat differs drastically from this concept. Fewer than 20 feet of elevation are lost from the high point on the edge of the playa to its bottom. In this environment, a slight change in elevation creates a series of plant communities grading from the edge to the playa center, mainly due to alkalinity and length of inundation.

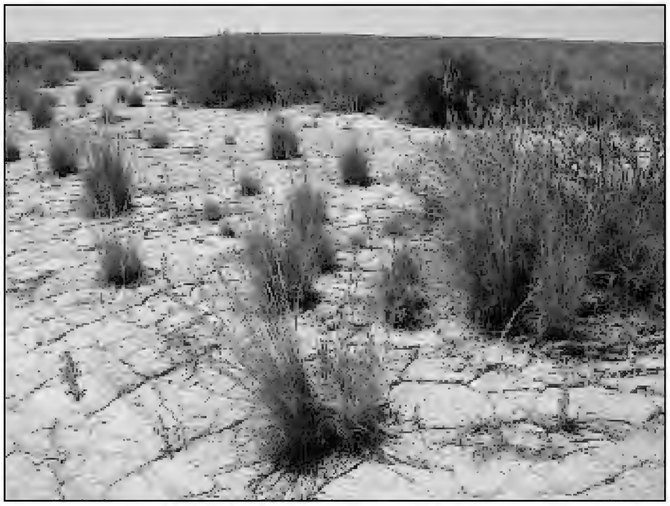
Ephemeral playa lakebeds are scattered across southeast Oregon. Because they hold seasonal water, the traditional management has been to dig a livestock waterhole in the lowest point on the playa. These waterholes typically hold water throughout the summer, attracting heavier use by cattle. On the Burns District, Foster Flat is the only large playa lakebed without a waterhole.

The 2,690-acre Foster Flat RNA was designated in the 1992 Three Rivers Resource Management Plan/Environmental Impact Statement (RMP/EIS). The Oregon Natural Heritage Plan of 1998 identified Foster Flat RNA as filling the cell need for silver sagebrush/Nevada bluegrass (*Artemisia cana*/*Poa nevadensis*=*Poa secunda*).

Plant Communities

Hydrology of the Foster Flat playa is natural, in that the amount of water on the playa depends entirely on local precipitation. In wet years, Foster Lake, at the north end of Foster Flat playa, may

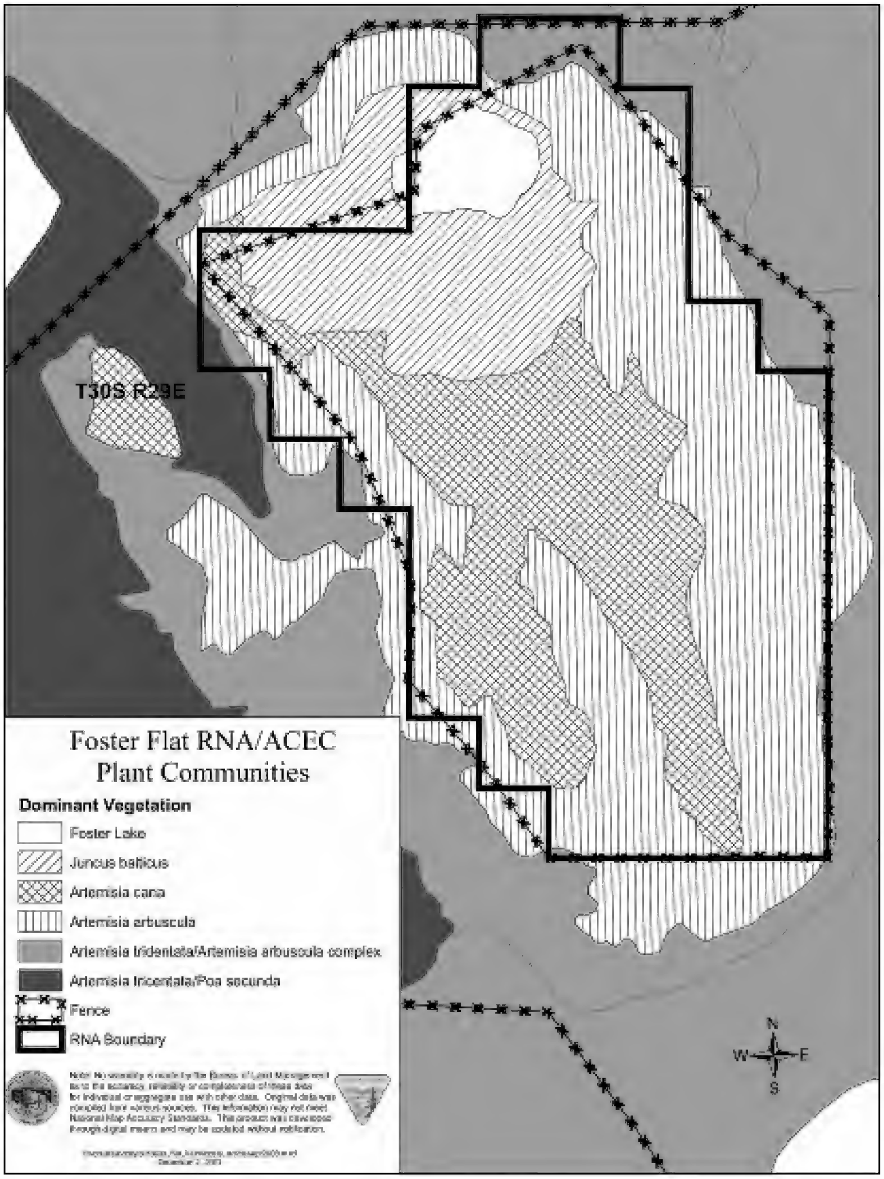
The view north across mixed big and low sagebrush toward the lower end of the playa at Foster Flat RNA. Photo by Nora Taylor.



Note cracks in the white, fine-grained soils in the silver sage/Nevada bluegrass community. During high winds, these soils contribute to dust storms. Photo by Nora Taylor.

be as large as 300 acres; however, during many years there is no water on the playa at all. The plant communities that form rings in and around the playa are primarily related to how long they are inundated in the years when there is sufficient rainfall and runoff to fill the playa. In low precipitation years, the bed of Foster Lake remains a bare, dry mudflat until late spring when tansy leaf evening primrose (*Camissonia tanacetifolia*) bursts into flower and turns the lakebed bright yellow. Flowering peaks between the beginning of June and the end of July; as with many desert species, phenology is influenced by precipitation. Although tansy leaf evening primrose tolerates moist alkaline soil, plant abundance is determined by water level. A deep rooted perennial that spreads by creeping roots, it is not known if tansy leaf evening primrose remains dormant in the soil during periods when plants are inundated year-round, or if it rapidly reestablishes from seed when water levels recede. Seeds that fall into cracks of dry soil are in an excellent position to germinate when moisture causes the soil to swell and close the cracks. The evening primrose is most abundant in the lowest part of the playa, Foster Lake, where the soil has the highest clay content, and thus, the most extreme shrink-swell cycle.

Grass-like species, primarily creeping spike rush (*Eleocharis palustris*) and Baltic rush (*Juncus balticus*) dominate the next ring around the lakebed. This community is characterized by low shrub cover. While the number of perennial and annual species is roughly equal, ground cover is dominated by perennial grass and grass-like species. Common perennials in this community include mat muhly (*Muhlenbergia richardsonis*), saltgrass (*Distichlis spicata*), bottlebrush squirreltail (*Elymus elymoides*), winged dock (*Rumex venosus*), creeping wildrye (*Elymus triticoides*), and desert combleaf (*Polyctenium fremontii*). Annuals include



Foster Flat RNA/ACEC plant communities. Map prepared by Nora Taylor.

alyssum (*Alyssum* sp.), alkali popcorn flower (*Plagiobothrys leptocladus*), spreading wallflower (*Erysimum repandum*) and least navarretia (*Navarretia leucocephala*).

As you move up from the bottom of the playa, shrubs increase in number. The first is silver sagebrush, because it tolerates the most inundation. The silver sagebrush/Baltic rush community grades into silver sagebrush/Nevada bluegrass (Franklin and Dyrness 1988). Low sagebrush/Sandberg bluegrass (*Artemisia arbuscula/Poa secunda*) grow on the highest ground within the playa. Hummocks of deeper soil found in this community are dominated by basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and bluebunch wheatgrass (*Pseudoroegneria spicata*). Surrounding the playa is the shrub steppe community of Wyoming big sagebrush/bunchgrass (*Artemisia tridentata* ssp. *wyomingensis*). Here the dominant grasses are Sandberg's bluegrass, Thurber's needlegrass (*Achnatherum thurberianum*), and bluebunch wheatgrass.

Flowers of tansy leaf evening primrose (*Camissonia tanacetifolia*) turn the lakebed bright yellow. Photo by Steve Matson.

Rare Plants

Desert or cone combleaf (*Polyctenium fremontii* var. *confertum*) occurs at the northern edge of the playa. This member of the mustard family occurs in only a handful of sites on the Burns district. It is a Bureau Sensitive, Federal Species of Concern. The more common variety of desert combleaf (*Polyctenium fremontii* var. *fremontii*) is abundant throughout the area. The two varieties can not be distinguished until they have ripe fruits. In *Polyctenium fremontii* var. *fremontii*, the siliques are over eight millimeters long and linear, only 1 to 1.5 mm wide. The tip of the silique is tapered and ends in a style that is .5 to 1 mm long. *Polyctenium fremontii* var. *confertum* has short, fat siliques. They are oblong, 4 to 6 mm long and 1.5 to 2.3 mm wide. They have been likened to small sausages. The tip of the silique is rounded and the style is much shorter than .5 mm.

Climate, Geology and Soils

Foster Flat is in the high lava plains of the Northern Basin and Range Ecoregion (Allan and others 2001). In this arid climate, the area receives only 8 to 12 inches of precipitation annually. Most of this occurs in the form of snow during the winter. Air temperatures fluctuate widely, both annually and diurnally. Extreme air temperatures range from 100°F in the summer to -30°F in the winter. Plant growth generally occurs between mid-April and mid-July.

Soils of the playa are deep, poorly drained, clays and silts. They have low permeability and moderate to great shrink-swell potential. Soils of the surrounding uplands are deep, rocky, loamy clays. Over time, rocks decompose and release alkaline minerals, including sodium salts and calcium carbonates. When these chemicals flow into an internally drained basin, salts accumulate when the water evaporates, rather than flowing away as they would if the playa had an outlet. As these compounds concentrate, the lowest parts of the playa become too alkaline for all but the most tolerant plants.

Looking southeast across Foster Flat at low sagebrush with Sandberg bluegrass; taller shrubs are green rabbitbrush and big sagebrush. In the background, Steens Mountain is 40 miles away. Photo by Nora Taylor.

Looking southeast at Steens Mountain on the horizon from Foster Flat playa where tansy leaf evening primrose has dried; Wyoming big sagebrush covers the ridge at the far side of the playa. Photo by Nora Taylor.

Grazing, Wild Horses, and Hunting

Designation of the RNA formally closed the playa to grazing by livestock and wild horses. A fence was constructed around the RNA in 1994. The Burns District is fortunate to have a highly cooperative grazing permittee who has been very diligent in ensuring that livestock do not enter the fenced exclosure.

Antelope buck with two does in the Wyoming big sagebrush/bunchgrass community. Photo by Mark Armstrong.

Foster Flat provides an excellent opportunity to view the rate at which biotic crusts and vascular plants recover after cessation of grazing. Comparison of areas inside and outside the RNA show well-developed crusting within the RNA compared to less well developed crust outside the exclosure, as well as an increase in forbs, grasses, and grass-like plants inside the exclosure fence.

The RNA is surrounded by the Warm Springs Wild Horse Herd Management Area which is managed for 111 to 202 horses. Wild horses frequent waterholes in the area. They have been seen in the RNA a few times, but they rarely stay long. Occasionally the gates have been left open (by unknown persons) after the livestock grazing season is over and horses have gone into the RNA, but they leave by the same route.

Sage grouse rooster in strutting pose. Photo by Mark Armstrong.

Despite the distance from population centers, Foster Flat has long been a popular destination for antelope and sage grouse hunting. There are reports that during the 1970s, hunters sometimes landed small planes on the playa, and after a morning hunt, left in the afternoon. Since exclusion of livestock by fencing the RNA, the bare area has become smaller, and areas surrounding the playa have become rougher, so that a landing now would be a bumpy experience.

Wildlife

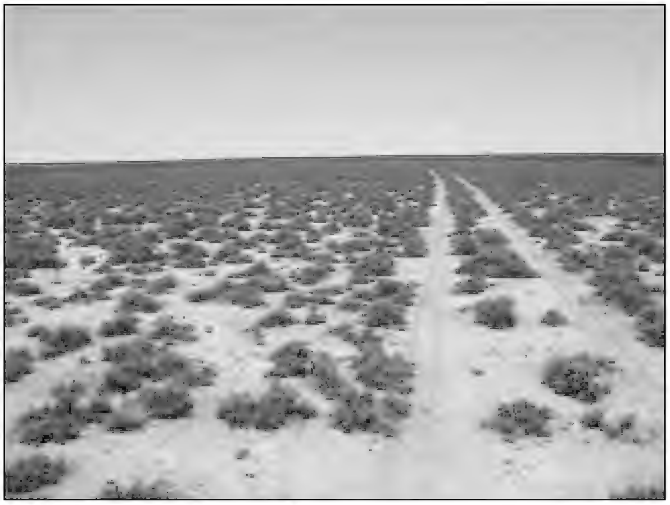
While the entire RNA is favored by pronghorn antelope (*Antilocapra americana*), the lakebed playa of Foster Lake is a particular favorite. It is not uncommon to see herds in excess of 100 animals kicking up dust clouds as they race across the flat. Sage grouse (*Centrocercus urophasianus*) can be found during most of the year in and around Foster Flat. The low vegetation on the playa surrounded by taller Wyoming big sagebrush makes this a preferred area. Within the low sagebrush zone are hummocks of basin big sagebrush where pygmy rabbits can be found. These diminutive rabbits are becoming scarce throughout their range and the RNA provides quality habitat for them.

Visiting Foster Flat RNA

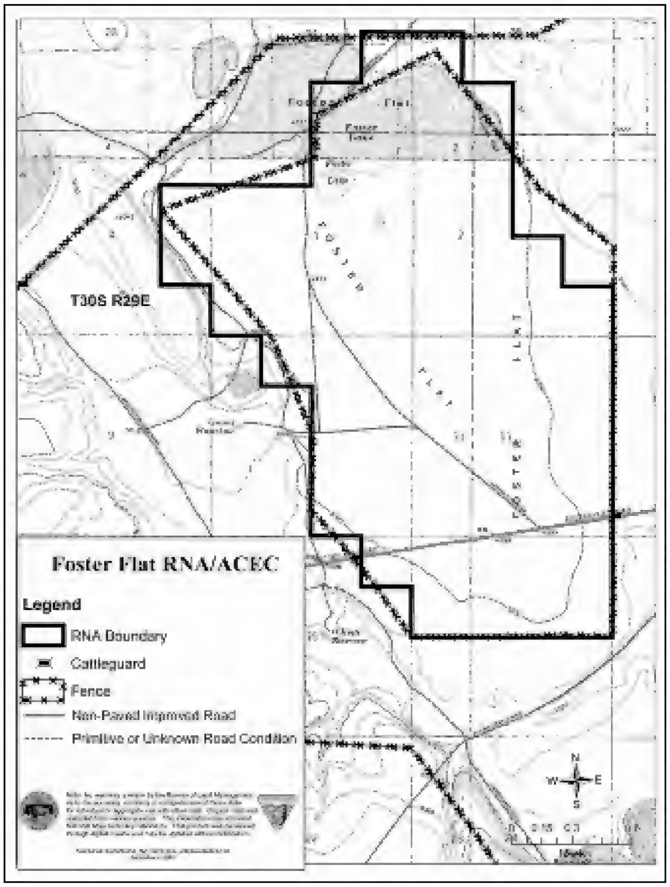
To get to Foster Flat, take State Highway 205 south from Burns to 1/3 of a mile south of milepost 38. Turn right onto the dirt road indicated by the green sign on the highway. Follow this road for 32 miles and you will enter the RNA over a cattleguard at the east side of the RNA. Vehicular travel in the RNA is restricted to existing roads and trails. Camping is prohibited inside the RNA, but there are approximately 600,000 acres of public land surrounding the RNA that is open to dispersed recreation. Although camping is not restricted, there may be seasonal fire restrictions in the summer. If dry camping in the middle of the desert is not to your taste, there is a historic hotel at Frenchglen, run by the Oregon State Parks Department, as well as a BLM campground. Frenchglen is 20 miles south of the Foster Flat turnoff on Highway 205.

Pygmy rabbit sitting by its burrow at the base of big sagebrush. Photo by Jerry Farstvedt.

Weather conditions are a consideration at all times of the year. When dry, the road off the paved highway is usually passable to most two-wheel drive vehicles that have a little clearance. In the



The view north across the playa in the low sagebrush community. This road along the northeast side of the RNA does not show on the map, but it is open to vehicular travel. Photo by Nora Taylor.



Map of Foster Flat RNA/ACEC. Map prepared by Nora Taylor.

spring or after a summer thundershower, the road is impassable to all vehicles. The soils are high in clay and the road is extremely slippery when muddy. Fortunately, the situation is evident immediately. If the first mile is slippery and hard to travel, simply turn around. It's only going to get worse and cell phone coverage is spotty.

The best time to visit Foster Flat is between early May and mid-July. The average peak of wildflower bloom is towards the end of June. Graminoids are green until mid-July. Tansy leaf evening primrose flowers between mid-June and mid-July. The RNA is generally inaccessible when sage grouse are strutting. If conditions do allow access, strutting sage grouse are easily observed. It is important to stay inside your vehicle as sage grouse ignore vehicles, but flush immediately when they see a person on foot. Repeated interruptions cause the grouse to abandon traditional strutting grounds. Pygmy rabbits are usually seen only for an instant as they dash to their burrows in the big sagebrush. The distinguishing feature of pygmy rabbits, other than their small size, is that they do not have a white cottontail. If you see a bunny with a cottontail, it is a mountain cottontail (*Sylvilagus nuttallii*). This late spring/early summer season is also when antelope kids can be seen running with the herds across the flat.

Books worth carrying as references on shrub steppe plants and communities include *Flora of Steens Mountain* (Mansfield 2000), *Sagebrush Country* (Taylor 1994) and *The Sagebrush Ocean* (Trimble 1989). Even when the weather is warming in the spring and summer, conditions can still be unpredictable so it is best to be prepared for anything. Sudden thunderstorms can make a road that was passable in the morning into a muddy quagmire in the afternoon. Snow can fall and temperatures can drop below freezing during any month of the year. Nevertheless, camping out on the desert is a special treat because there is no light pollution; the stars put on a spectacular show. You feel part of the high desert as the coyotes sing you to sleep in the evening and wake you in the morning.

References

Allan S, Buckley AR, Meacham JE. 2001. Atlas of Oregon. 2nd ed. Eugene (OR): University of Oregon Press. 301 p.
Franklin JF, Dyrness CT. 1988. Natural vegetation of Oregon and Washington. Corvallis (OR): Oregon State University Press. 452 p.
Mansfield DH. 2000. Flora of Steens Mountain. Corvallis (OR): Oregon State University Press. 410 p.
Taylor RJ. 1994. Sagebrush Country: A Wildflower Sanctuary. Missoula (MT): Mountain Press Publishing Company. 211 p.
Trimble S. 1989. The Sagebrush Ocean. Reno (NV): University of Nevada Press. 248 p.

Vascular Plant Species List

Species that have special Federal or State status are noted by an asterisk before the scientific name. Nomenclature follows the Oregon Flora Project checklist. Names of taxa native to Oregon are printed in italic *Garamond*; alien taxa are in italic *Gill Sans*, a sans-serif type.

DICOTYLEDONS

APIACEAE (Carrot Family)
Lomatium triternatum (Pursh) J.M. Coult. & Rose (nine leaf biscuitroot)
Lomatium vaginatum J.M. Coult. & Rose (broadsheath desertparsley)
ASTERACEAE (Sunflower Family)
Achillea millefolium L. (common yarrow)
Agoseris glauca (Pursh) Raf. (pale agoseris)
Artemisia tridentata Nutt. ssp. *tridentata* (basin big sagebrush)
Artemisia tridentata Nutt. ssp. *wyomingensis* Beetle & A. Young (Wyoming big sagebrush)
Artemisia arbuscula Nutt. (low sagebrush)
Artemisia cana Pursh (silver sagebrush)
Balsamorhiza hookeri Nutt. (hairy balsamroot)
Balsamorhiza serrata A. Nelson & J.F. Macbr. (toothed balsamroot)
Crepis acuminata Nutt. (tapertip hawksbeard)
Crepis occidentalis Nutt. (western hawksbeard)
Ericameria nauseosa (Pall. ex Pursh) G.L. Nesom & G.I. Baird (rubber rabbitbrush)
Ericameria viscidiflora (Hook.) L.C. Anderson (green rabbitbrush)
Erigeron chrysopsidis A. Gray ssp. *austiniae* (Greene) G.L. Nesom (dwarf yellow fleabane)
Erigeron pumulis Nutt. (shaggy fleabane)
Iva axillaris Pursh (poverty weed)

Pyrrocoma carthamoides Hook. (large-flower goldenweed)
Senecio integerrimus Nutt. var. *exaltatus* (Nutt.) Cronquist (tall western groundsel)
Taraxacum officinale Weber ex F.H. Wigg. (common dandelion)
Tragopogon dubius Scop. (yellow salsify)
BORAGINACEAE (Borage Family)
Plagiobothrys leptocladus (Greene) I.M. Johnst. (alkali popcorn flower)
BRASSICACEAE (Mustard Family)
Alyssum alyssoides (L.) L. (pale alyssum)
Arabis holboellii Hornem. (Holboell's rockcress)
Cardaria draba (L.) Desv. (hoary cress)
Descurainia sophia (L.) Webb ex Prantl (flixweed)
Draba albertina Greene (slender whitlowgrass)
Draba verna L. (spring whitlowgrass)
Erysimum repandum L. (spreading wallflower)
Lepidium perfoliata L. (clasping pepperweed)
Phoenicaulis cheiranthoides Nutt. ex Torr. & A. Gray (daggerpod)
Polyctenium fremontii (S. Watson) Greene var. *confertum* Rollins (cone combleaf)
Polyctenium fremontii (S. Watson) Greene var. *fremontii* (desert combleaf)
CAMPANULACEAE (Bellflower Family)
Downingia elegans (Douglas ex Lindl.) Torr. (elegant downingia)
CHENOPODIACEAE (Goosefoot Family)
Chenopodium foliosum (Moench) Asch. (leafy goosefoot)
Chenopodium leptophyllum (Moq.) S. Watson (narrowleaf goosefoot)
FABACEAE (Legume Family)
Astragalus curvicarpus (A. Heller) J.F. Macbr. (sickle milkvetch)
Astragalus filipes Torr. ex A. Gray (basalt milkvetch)
Astragalus lentiginosus Douglas ex Hook. (specklepod milkvetch)
Astragalus purshii Douglas ex Hook. (woolypod milkvetch)
Lupinus argenteus Pursh (silvery lupine)
Lupinus polyphyllus Lindl. var. *saxosus* (Howell) Barneby (rock lupine)
Trifolium gymnocarpon Nutt. (hollyleaf clover)
ONAGRACEAE (Evening Primrose Family)
Camissonia tanacetifolia (Torr. & A. Gray) P.H. Raven (tansy leaf evening primrose)
Epilobium brachycarpum C. Presl (tall annual willow-herb)
Gayophytum diffusum Torr. & A. Gray ssp. *parviflorum* F.H. Lewis & Szweyk. (spreading groundsmoke)
Gayophytum humile Juss. (dwarf groundsmoke)
POLEMONIACEAE (Phlox Family)
Collomia linearis Nutt. (narrow-leaf collomia)
Eriastrum sparsiflorum (Eastw.) H. Mason (Great Basin woolstar)
Leptodactylon pungens (Torr.) Nutt. (granite pricklygilia)
Navarretia leucocephala Benth ssp. *minima* (Nutt.) A.G. Day (least navarretia)
Phlox gracilis (Hook.) Greene (annual phlox)
Phlox longifolia Nutt. (long-leaf phlox)
Phlox hoodii Richardson (Hood's phlox)
POLYGONACEAE (Buckwheat Family)
Eriogonum ovalifolium Nutt. (cushion buckwheat)
Eriogonum sphaerocephalum Douglas ex Benth. (rock buckwheat)
Eriogonum umbellatum Torr. var. *umbellatum* (sulfur buckwheat)
Polygonum aviculare L. (prostrate knotweed)
Rumex venosus Pursh (winged dock)
PORTULACACEAE (Purslane Family)
Lewisia rediviva Pursh (bitterroot)
RANUNCULACEAE (Buttercup Family)
Delphinium andersonii A. Gray (desert larkspur)
Ranunculus testiculatus Crantz (bur buttercup)
SAXIFRAGACEAE (Saxifrage Family)
Lithophragma glabrum Nutt. (smooth fringecup)
SCROPHULARIACEAE (Figwort Family)
Collinsia parviflora Douglas ex Lindl. (small-flowered blue-eyed Mary)
Cordylanthus ramosus Nutt. (bushy bird's beak)
Penstemon cusickii A. Gray (Cusick's beardtongue)

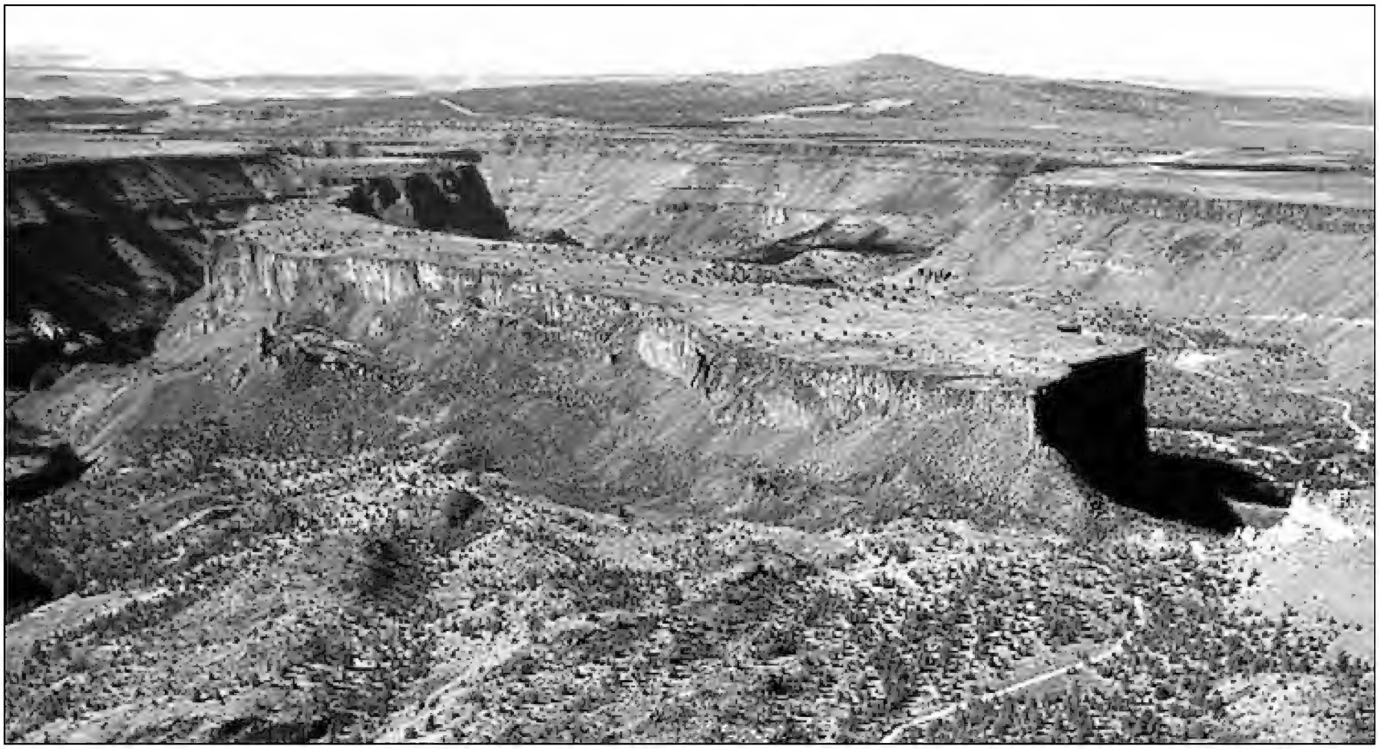
MONOCOTYLEDONS

CYPERACEAE (Sedge Family)
Carex sp. (sedge)
Eleocharis palustris (L.) Roem. & Schult. (creeping spike rush)
JUNCACEAE (Rush Family)
Juncus balticus Willd. (Baltic rush)
LILIACEAE (Lily Family)
Allium acuminatum Hook. (tapertip onion)
Allium tolmiei Baker (flat-leaf onion)
POACEAE (Grass Family)
Achnatherum thurberianum (Piper) Barkworth (Thurber's needlegrass)
Bromus tectorum L. (cheatgrass)
Distichlis spicata (L.) Greene (inland saltgrass)
Echinochloa crus-galli (L.) P. Beauv. (large barnyard-grass)
Elymus elymoides (Raf.) Swezey (bottlebrush squirreltail)
Koeleria macrantha (Ledeb.) Schult. (prairie junegrass)
Leymus cinereus (Scribn. & Merr.) A. Löve (basin wildrye)
Leymus triticoides (Buckley) Pilg. (beardless wildrye)
Muhlenbergia richardsonis (Trin.) Rydb. (mat muhly)
Poa secunda J. Presl ssp. *juncifolia* (Scribn.) Soreng (Nevada bluegrass)
Poa secunda J. Presl (Sandberg bluegrass)
Pseudoroegneria spicata (Pursh) A. Löve (bluebunch wheatgrass)

Nora Taylor is the district botanist in the Burns BLM District. She has worked in Burns for 22 years in both the botany and grazing management program.

The Island

Ron Halvorson
Prineville District BLM, 3050 NE 3rd Street, Prineville, OR 97754



The Island in 1959, prior to the filling of Lake Billy Chinook. Photo by Kinney, Oregon State Highway Department (now ODOT; Oregon State Parks Division was separated from ODOT into the Oregon State Parks Department in 1990.)

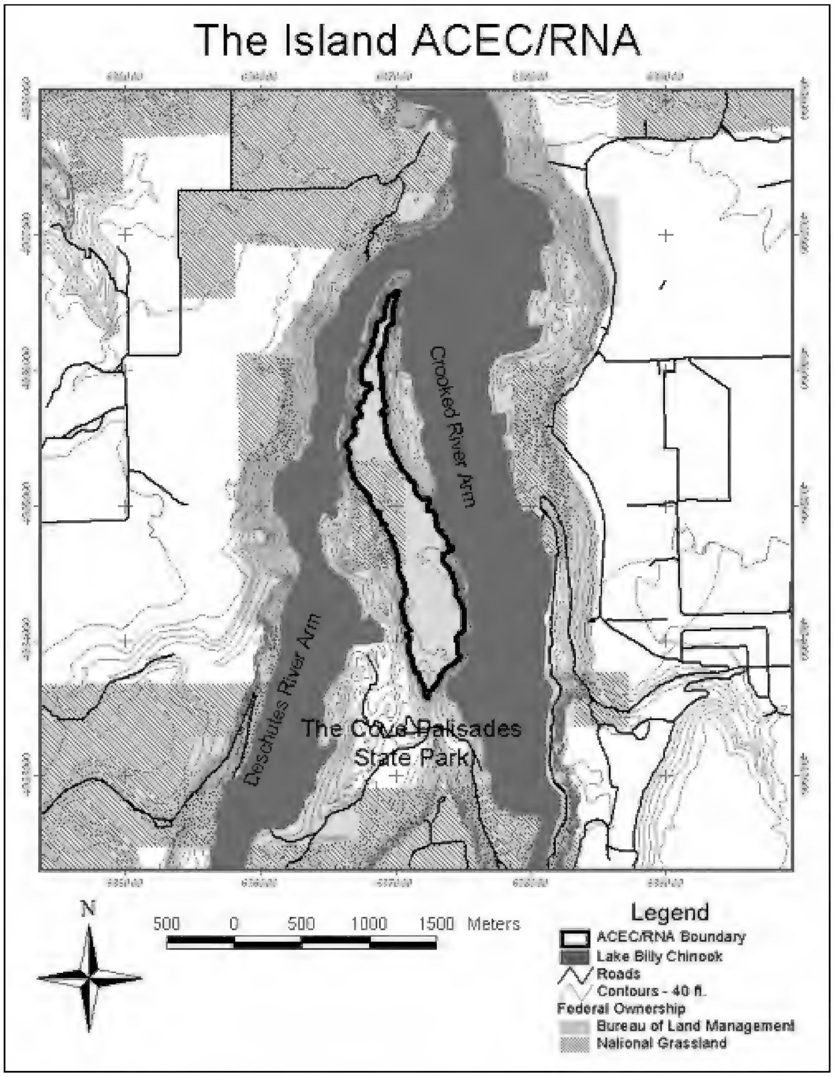
> *It has been grazed lightly for one season about forty years ago. It is the only sizable ungrazed shrub-grass community I know of in the Northwest, and as such is of primary value as a scientific natural area… A new reservoir has been filled and a campground constructed… For the first time, the general public will be tempted to utilize this mesa. It is just too fragile to take any intensive public use… Delays could be disastrous to this splendid natural area.*

So read portions of a letter from William B. Morse, Oregon Field Representative for the Wildlife Management Institute, to Charles H. Stoddard, Director of the Bureau of Land Management (BLM), on April 7, 1965. The letter was meant to prod the BLM and Forest Service to set aside a plateau in Jefferson County, Oregon, known as "The Island," as a natural area for research (Morse 1965).

The Island is a peninsula with vertical cliffs on three sides that rise 200 to 700 feet above the adjacent river canyon (Driscoll 1964). Despite being a full 200 feet lower than the basalt tablelands across the river, The Island is a prominent feature when viewed from several auto-accessible viewpoints to the east. Even though the apparent height of the cliffs was lessened with the filling of Lake Billy Chinook in the mid-1960s, The Island remains a formidable fortress. One can't help but wonder how it was formed, what plants are found there and how in the world it can be ascended.

In 1986, thirty-one years after Morse's appeal, The Island was finally designated an ACEC/RNA. Located nine air miles southwest of Madras, at the confluence of the Crooked and Deschutes rivers, The Island ACEC/RNA lies within the confines of The Cove Palisades State Park. When Round Butte Dam backed up the Deschutes River on the west side of The Island and the Crooked River on the east side, forming modern Lake Billy Chinook, the plateau became a peninsula in the reservoir. The nearly 200-acre basalt plateau is managed jointly by the BLM (158 acres) and the Crooked River National Grassland of the US Forest Service (41 acres), with The Cove Palisades State Park serving as an integral partner. Although 1¾ miles long, the Natural Area measures only ¼ mile at its widest point.

The Island received RNA status because it filled cells in the Blue Mountains Ecoregion for two native plant associations, including perhaps the best remaining example of undisturbed native communities of western juniper/big sagebrush/bluebunch wheatgrass in Oregon (Greene 1984) and western juniper/big sagebrush-bitterbrush (Oregon Natural Heritage Plan). And, as mentioned in the Morse letter, domestic livestock grazed these communities only once, in 1921.



Map of The Island ACEC/RNA. The Island is a peninsula at the confluence of the Crooked and Deschutes Rivers, overlooking Lake Billy Chinook.

Soils

Soils consist of the Degner and Era series (NRCS Soil Survey Division 2003). The Degner soils are gravelly clays with a depth to bedrock of about 40 inches. They are well-drained with medium to rapid runoff and moderately slow permeability. The Era series consists of deep and very deep, well drained, coarse to loamy soils formed from wind-borne parent material high in ash. They are well to somewhat excessively drained, with moderately rapid permeability.

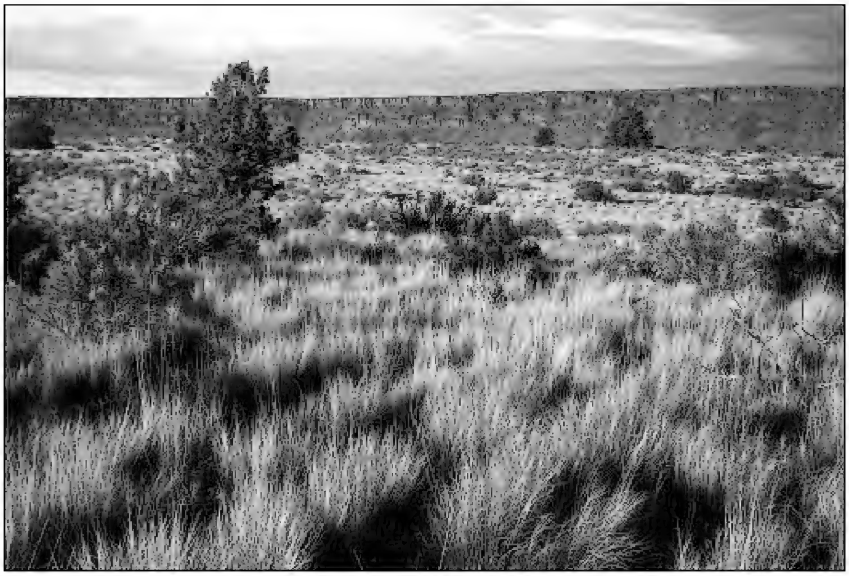
Geology

Just looking at The Island you can tell it is the result of some magnificent geologic event from the distant past. As with much of central Oregon, its geologic history is tied to volcanic activity, including basalt flows and deposits of ash, tuff, and coarse volcanic sand. An ancient basalt flow covered the landscape of central Oregon, forming extensive plateaus, into which the Deschutes, Crooked, and Metolius rivers cut deep canyons. Later, thin fluid basalt flowed north from the flanks of Newberry Crater (south of Bend), traveling 60 miles overland to spill into the ancestral Crooked River canyon above what is now Smith Rock State Park. This flow dammed the river, causing the water to form a lake where the present city of Prineville is located. Downstream, the basalt obliterated the Crooked River, flowing through its canyon and through the Smith Rock area. Continuing through the area of The Cove Palisades State Park, the basalt backed up both the Deschutes and Metolius river canyons near Pelton Dam, about nine miles north of The Island. These flows continued, filling the canyons almost to the brim. Once the flows cooled, the rivers began eroding down through weak spots in the flows, reclaiming their canyons. Over time, virtually all of this newer intra-canyon flow of basalt eroded, leaving The Island and some other scattered "hanging plateaus" as the only remnants of this great event (P. Patton, pers. comm.).

Climate

Since the elevation of The Island (2,400 feet) is similar to that of nearby Madras (2,440 feet), climate information from that weather station is used for the following description (Oregon Climate Service 2002). Long term annual precipitation averages 12 inches, thus plants growing on The Island are adapted to xeric conditions, typical of the shrub steppes of eastern Oregon. Most of the moisture falls as snow in the winter (average 17.7 inches per year) or in the context of short, severe summer thundershowers. The summers are usually dry, and very warm. Mean maximum temperature in July and August is 84°F, with recorded maximums of 105 and 106°F. On average, temperatures exceed 90°F nearly 10 days during each of these two months. At times, daily high temperatures exceeding 100°F have been recorded during the months May through September. During the winter months, average temperatures hover between 30 and 40°F with recorded minimums down to -16°F.

The Island in 1964. The newly constructed office and shop complex of The Cove Palisades State Park can be seen at the base of the plateau. BLM file photo.



Native bluebunch wheatgrass community, looking northeast from the southern part of the RNA. In the foreground, scattered bitterbrush, big sagebrush and western juniper over a dense cover of bluebunch wheatgrass indicate a relatively recent wildfire. The background area of big sagebrush did not burn. BLM file photo.

Plant Communities

From a distance, The Island looks like it should harbor unique or endemic species, but the Natural Area contains species similar to other sites in the *Juniperus occidentalis* zone, which lies between the xeric shrub steppe to the southeast and the more mesic *Pinus ponderosa* forest to the west (Franklin and Dyrness 1988). The landscape of The Island is generally dominated by either big sagebrush (*Artemisia tridentata*) or antelope bitterbrush (*Purshia tridentata*) with an herbaceous understory of bluebunch wheatgrass (*Pseudoroegneria spicata*) and Idaho fescue (*Festuca idahoensis*). Western juniper (*Juniperus occidentalis*) is scattered throughout. Stiff sagebrush (*Artemisia rigida*), oceanspray (*Holodiscus discolor*) and curlleaf mountain mahogany (*Cercocarpus ledifolius*) dominate areas of shallow, rocky soils. Common understory species include fleabanes (*Erigeron*), milkvetches (*Astragalus*), buckwheats (*Eriogonum*) and penstemons (*Penstemon*), to name some of the more common genera. We have identified nearly 130 taxa so far, encompassed by 27 families.

Livestock Grazing

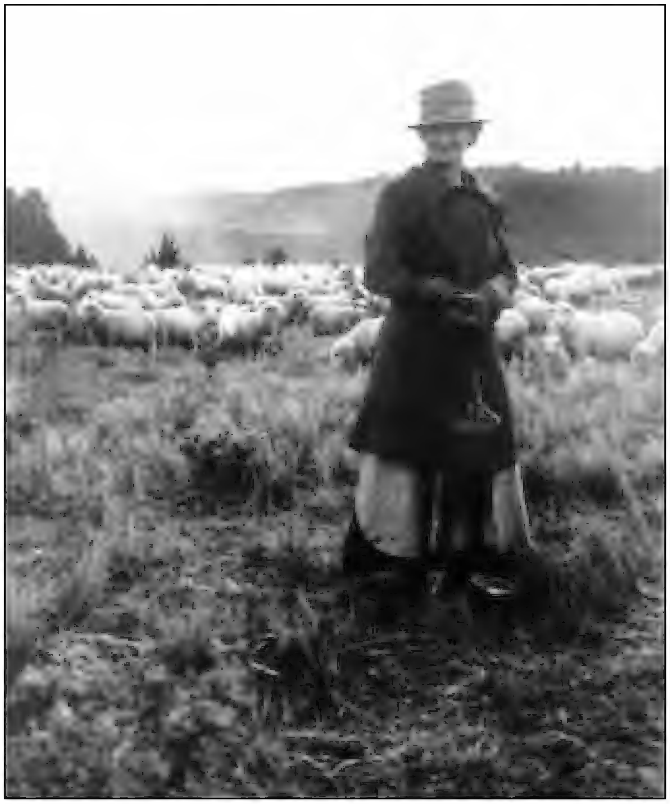
While the plant species and communities are common to central Oregon, the lack of grazing disturbance with European settlement sets the The Island apart. It is extremely rare to find flat, ungrazed areas in the West. The story of the single grazing event on The Island, during the spring of 1921, is a tribute to tenacity and ingenuity (Robinson 2003). A band of sheep were trailed to this "No-Man's-Land" using a narrow passage through the boulders and cliffs on the southwest side of the Natural Area. Water for the sheep was apparently piped up from the Crooked River, hundreds of feet below, using a ram-jet type of pump (Robinson 2003).

Only minor traces of this grazing event persist. One can still find a few remains of the old sheep camp and some small areas now dominated by introduced annual vegetation may mark old sheep bed grounds, but for the most part, the vegetation appears unaltered. Bluebunch wheatgrass and Idaho fescue, those bunchgrasses most palatable to livestock, remain robust, their great crowns protecting large expanses of soil with both living and dead material. Due in large part to the lack of water and the difficulty of moving animals up the steep, narrow trail, livestock grazing has historically been impractical on The Island; this impediment is now reinforced by a management plan designed to protect the nearly pristine plant communities.

Fire

Hot, dry summers punctuated by occasional thunderstorms, are the catalyst for the most obvious natural disturbance The Island faces: lightning-caused fires. If you wander across the essentially flat plateau, you will see fire-scarred hulks of ancient juniper trees that attest to various lightning-caused blazes from years past. Most of these lightning fires burned less than an acre, often only a single tree. In other places, though, lush bunchgrass in an area lacking the juniper or sagebrush overstory testifies to a larger fire.

Since 1960, canopy coverage by western juniper has more than doubled (from just under 5% to nearly 10%), according to a study by Knapp and Soulé (1996). The absence of sizable fires in recent years is believed to have contributed to this measurable increase in



Harriet Ralston, grandmother of Dorothy Robinson, at sheep camp on The Island, in 1921. The Island was grazed during only one season, but was a popular hiking and picnic destination for homesteaders. Photo contributed by Dorothy Robinson, photographer unknown.

woody vegetation on The Island. During the last 30 years, perennial herbaceous species decreased from one-half of total cover to a little more than one-third, while shrub cover increased from one-third to two-fifths. The management plan for The Island includes a prescribed natural fire plan. If certain conditions are met (i.e., concerning weather, personnel and equipment), natural fire is allowed to burn, and monitored to prevent damage to resources outside the RNA, most importantly the Cove Palisades State Park facilities just below the rim.

A fire, ignited on July 14, 1997, burned a juniper tree and crept through a small area dominated by big sagebrush and bluebunch wheatgrass. Today, only the aging remains of the juniper and an area dominated by cheatgrass indicate where the fire burned. Photo by Ron Halvorson.

Noxious Weeds

In addition to this relative shift in dominance between woody and herbaceous components, integrity of the plant community is threatened by noxious weeds. Medusahead (*Taeniatherum caput-medusae*), an annual from the steppes of Asia, was first documented on The Island in the early 1990s. While it appears to favor the deeper clay soils, several small populations have established throughout the Natural Area. With herbicides not an option in this fragile area, hand-pulling of this pesky invader has occurred annually during the last 10 years, with BLM, the High Desert Chapter of the Native Plant Society of Oregon and the Youth Conservation Corps all participating.

BLM managers recognize that while hand-pulling of medusahead is an introduced management activity and not a natural ecosystem process, they believe that the benefits of removing an invader outweigh any potential undesirable side effects. Medusahead and other non-native plants pose a greater threat to the ecological integrity of this area than the manual weed control. It's unclear at this point if these measures are effective.

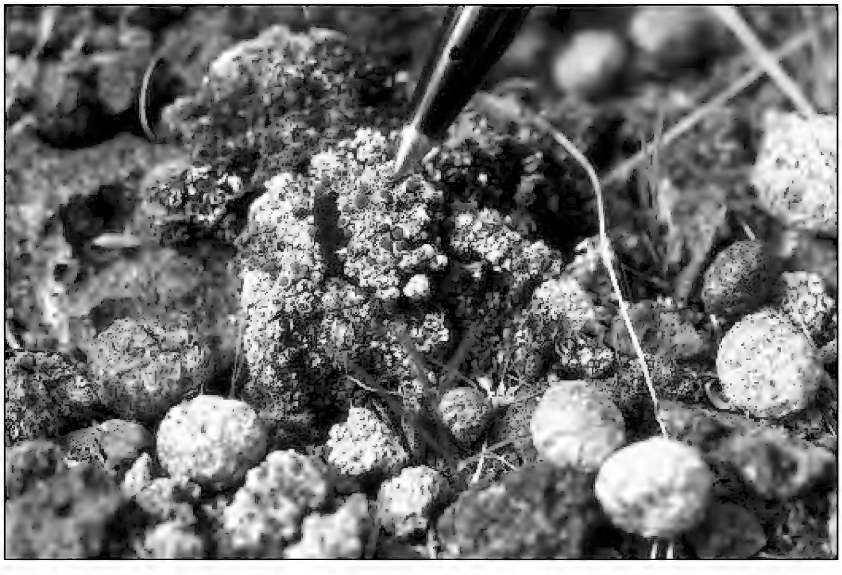
Rare/Endemic/Out-of-Range Species

While The Island contains no rare or unusual vascular plants, a healthy population of the woven-spored lichen (*Texosporium sancti-jacobi*) is found here. This lichen enjoys a substrate of decomposing organic matter, especially that of Sandberg bluegrass (*Poa secunda*), in areas dominated by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and in generally undisturbed plant communities (DeBolt 1998). According to the Washington Department of Natural Resources, 15 populations are known in Washington, Idaho, California, and Oregon (DNR 1999). Fire suppression would likely benefit this little denizen because it is apparently damaged by fire (DeBolt 1998). Also, conversion to annual grassland (e.g., medusahead) would harm the lichen by shortening the fire return interval. Prescribed natural fire could also adversely affect this species.

Human History and Use

Information from other sites in the area indicates that small groups of native people were visiting the vicinity as early as 8,000 years ago (R. Gregory, pers. comm.). While in the area, native people hunted both large and small game and gathered various plants for food, medicine and shelter. They probably fished both the Deschutes and Crooked Rivers. People briefly occupied sites while local resources were harvested and then moved on to another area and different resources. The Island supports several species used by native people, although these plants are not present in great density. These species include *Allium douglasii* (Douglas' onion), *Allium macrum* (rock onion), *Allium parvum* (small onion), *Calochortus macrocarpus* (sagebrush mariposa lily), *Fritillaria pudica* (yellow fritillary), *Lomatium canbyi* (Canby's biscuitroot), *Lomatium cous* (cous biscuitroot) and *Lomatium macrocarpum* (bigseed biscuitroot). The Island and the larger adjacent area were part of the lands ceded to the Federal Government by the Warm Springs and Wasco Indians as part of the Middle Oregon Treaty of 1855 (Gregory, pers. comm.).

The Island has been a popular recreational destination since the homestead era. Prior to filling of the reservoir, there were several homesteads in the surrounding river canyons. Access to the top of the plateau was the same then is as it is now: a single, steep, rocky trail on its southwest side. A 30-minute hike takes you to the top;



Woven-spored lichen (*Texosporium sancti-jacobi*), a rare cryptogam, lives on decomposing organic matter. Photo by Ron Halvorson.

one misstep on the way down could shorten the return trip to an estimated five seconds. Recalling early outings, Dorothy Robinson wrote:

> *At one time during my childhood my family lived for about three or four years in a three-room cabin on a small farm on the Deschutes River about two or three miles from The Island, the site of which is now under water. The plateau that you know as The Island was known to us as "No-Man's Land." During the time we lived in the canyon, a favorite outing was to hike up No-Man's Land. I can remember one such hike when I was probably about ten years of age. My dad took us on such a hike and pointed out the site of the sheep camp. I recall that at that site we found one old woman's high top shoe, which presumably belonged to my grandmother, and the broken remains of a home-made chair made from willows* (Robinson 2003).

In May 1988 members of NPSO enjoyed a field trip learning about the flora and ecological aspects of The Island. The trip was led by Dr. Stu Garrett, seated, in the back just right of center. Photo by Ron Halvorson.

A persistent story deals with some deep basalt crevices on the western side of the Natural Area. Local lore maintains that during Prohibition one of these cracks was used to hide a moonshine still. Reportedly, there are hand-cut steps in the basalt that were used for access and copper tubing was found in the bottom. Fact or fiction, who knows?

More recently, The Island became a favorite hiking destination; the number of visitors amplified by proximity to The Cove Palisades State Park. In the 1990s concern arose over the high levels of visitor use and the impact this was having on ecological research values. Hikers were establishing casual use trails and introducing noxious weeds. By 1996, the number of visitors approached 600 annually, including nearly 200 distinct "groups" (BLM 1997).

Consequently, in 1997 The Island was closed to casual recreational access. Today access is exclusively by permit and given only to documented researchers and to field trip groups that are officially sponsored by academic/educational institutions or conservation/resource groups. The permit system is administered by The Cove Palisades State Park. Since the only access trail, a steep, rocky, veiled route through the boulders and cliffs, is directly outside the Park's office, enforcement is easy. Groups are limited to no more than 16 participants.

Wildlife

Wildlife generally consists of species common to the area such as mule deer, cottontail and jack rabbits, voles, and various species of birds and reptiles, including lizards and rattlesnakes. At least one pair of turkey vultures nests on the basalt escarpment and a golden eagle nest is frequently occupied on the cliffs to the east. To encourage eagle reproduction, the entire Natural Area is closed to all human access each year from February 15 through April 30.

The Island hosts one unusual species of wildlife, the striped whiptail lizard (*Cnemidophorus velox*). Endemic to the Desert Southwest, this lizard apparently became established in The Cove Palisades State Park by escaping from a recreational vehicle, and has expanded to the southern tip of the Natural Area (P. Patton, pers. comm.). The interesting note about this species is that it is parthenogenic, i.e., it can reproduce without a mate. It is unclear what effect, if any, this species will have on the natural values of The Island.

The Island ACEC is, truly, a unique place in Oregon's geography. With proper care this area should provide an outdoor laboratory for generations to come.

Visiting The Island

From Madras, travel on SW Culver Highway approximately 7 miles to SW Gem Lane. Turn right (west) and travel 1½ miles to SW Frazier Drive. Turn left (south) and travel ¼ mile to SW Peck Road. Continue west, enter the Cove Palisades State Park and begin the descent to the Crooked River. After about 4 miles traveling south on the east side of the reservoir, cross the Crooked River and then continue north another mile to a parking area by the Crooked River Petroglyph. These are all paved roads. The moderately difficult access trail to The Island is due north of this parking area.

It is important to remember that access is limited to valid researchers and bona-fide conservation/educational groups with a permit issued by Cove Palisades State Park. *Use is tightly controlled and people can not access this RNA on their own. The natural area is closed to ALL access from February 15 through April 30.* For further information you can contact Paul Patton of Oregon Parks and Recreation Department (Smith Rock State Park, 9241 NE Crooked River Drive, Terrebonne, OR 97760) or Ron Halvorson, BLM Prineville District, 3050 NE Third St., Prineville, OR 97754.

Acknowledgments

R. Gregory, BLM cultural resource specialist, provided information on human history of The Island and Paul Patton, Oregon State Parks Department district interpretive specialist, the geological history. In addition to BLM, contributors to the vascular plant list include the High Desert Chapter of the Native Plant Society of Oregon and personnel from Oregon State University, Corvallis, Oregon.

References

[BLM] Bureau of Land Management. 1997. The Island ACEC: Natural Area Management Plan Amendment. Prineville (OR): BLM Prineville District.
[DNR] Department of Natural Resources Washington Natural Heritage Program. 1999. Field Guide to Selected Rare Vascular Plants of Washington. http://www.dnr.wa.gov/nhp/refdesk/fguide/htm/4tsanctitxt.htm. Accessed 2003 Sept 24.
Driscoll R. 1964. A relict area in the central Oregon juniper zone. Ecology 45:345-353.
Franklin JF, Dyrness CT. 1988. Natural vegetation of Oregon and Washington. Corvallis (OR): Oregon State University Press. 452 p.
Greene S. 1984. Letter to BLM Prineville District from Sarah Greene, Oregon RNA Coordinator, on file at BLM Prineville District office.
Knapp PA, Soulé PT. 1996. Vegetation change and the role of atmospheric CO$_2$ enrichment on a relict site in central Oregon: 1960-1994. Ann Assoc Am Geographers 86(3):387-411.
Morse W. 1965. Letter to Charles H. Stoddard, on file at BLM Prineville District office.
Oregon Climate Service. Climate for Madras, Oregon. <<http://www.ocs.orst.edu/pub_ftp/climate_data/mme2/355142.gif>>. Accessed 2003 Sept 24.
Robinson D. 2003. Letter on file at BLM Prineville District office.
[USDA NRCS] Natural Resources Conservation Service Soil Survey Division. 2003. Official Soil Series Descriptions. http://ortho.ftw.nrcs.usda.gov/osd/. Accessed 2003 Sept 24.

Vascular Plant Species List

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FERNS AND THEIR ALLIES

PTERIDACEAE (Brake Family)
Cheilanthes gracillima D.C. Eaton (lace lipfern)
Pentagramma triangularis (Kaulf.) Yatsk., Windham, E. Wollenw. (goldback fern)

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)
Juniperus occidentalis Hook. (western juniper)

DICOTYLEDONS

APIACEAE (Carrot Family)
Lomatium canbyi J.M. Coult. & Rose (Canby's biscuitroot)
Lomatium cous (S. Watson) J.M. Coult. & Rose (cous biscuitroot)
Lomatium macrocarpum (Nutt.) J.M. Coult. & Rose (large fruited biscuitroot)
Lomatium triternatum (Pursh) J.M. Coult. & Rose (nineleaf biscuitroot)
ASTERACEAE (Sunflower Family)
Achillea millefolium L. (common yarrow)
Agoseris heterophylla (Nutt.) Greene (annual agoseris)
Antennaria dimorpha (Nutt.) Torr. & A. Gray (low pussytoes)
Artemisia rigida (Nutt.) A. Gray (scabland sagebrush)
Artemisia tridentata Nutt. (big sagebrush)
Balsamorhiza careyana A. Gray (Carey's balsamroot)
Blepharipappus scaber Hook. (rough eyelash)
Crepis occidentalis Nutt. (largeflower hawksbeard)
Ericameria humilis (Greene) L.C. Anderson (green rabbitbrush)
Ericameria nauseosa (Pall. ex Pursh) G.L. Nesom & G.I. Baird (rubber rabbitbrush)
Ericameria resinosa Nutt. (Columbian goldenbush)
Erigeron filifolius (Hook.) Nutt. (threadleaf fleabane)
Erigeron linearis (Hook.) Piper (desert yellow fleabane)
Erigeron poliospermus A. Gray (cushion fleabane)
Eriophyllum lanatum (Pursh) J. Forbes (common woolly sunflower)
Hemizonella minima (A. Gray) A. Gray (oppositeleaved tarweed)
Lactuca serriola L. (prickly lettuce)
Lagophylla ramosissima Nutt. (branched lagophylla)
Layia glandulosa (Hook.) Hook. & Arn. (whitedaisy tidytips)
Nothocalais troximoides (A. Gray) Greene (false agoseris)
Rigiopappus leptocladus A. Gray (bristlehead)
Senecio canus Hook. (woolly groundsel)
Stylocline filaginea M. Peck (baretwig neststraw)
Tetradymia canescens DC. (spineless horsebrush)
Tragopogon dubius Scop. (yellow salsify)
Uropappus lindleyi (DC.) Nutt. (silverpuffs)
BORAGINACEAE (Borage Family)
Amsinckia menziesii (Lehm.) A. Nelson & J.F. Macbr. (Menzies' fiddleneck)
Cryptantha ambigua (A. Gray) Greene (obscure Cryptantha)
Cryptantha flaccida (Douglas ex Lehm.) Greene (weakstem cryptantha)
Hackelia diffusa (Lehm.) I.M. Johnst. var. *cottonii* (Piper) R.L. Carr (diffuse stickseed)
Plagiobothrys tenellus (Nutt.) A. Gray (Pacific popcornflower)
Tiquilia nuttallii (Hook.) A.T. Richardson (Nuttall's crinklemat)
BRASSICACEAE (Mustard Family)
Arabis sparsiflora Nutt. (sicklepod rockcress)
Camelina microcarpa Andrz. ex DC. (littlepod false flax)
Descurainia pinnata (Walter) Britton (western tansymustard)
Draba verna L. (spring draba)
Idahoa scapigera (Hook.) A. Nelson & J.F. Macbr. (flatpod)
Sisymbrium altissimum L. (tall tumblemustard)
Thelypodium laciniatum (Hook.) Endl. (western thelypodium)
Thysanocarpus curvipes Hook. (sand fringepod)
CARYOPHYLLACEAE (Pink Family)
Holosteum umbellatum L. (jagged chickweed)
CRASSULACEAE (Stonecrop Family)
Sedum (stonecrop)
FABACEAE (Legume Family)
Astragalus conjunctus S. Watson (Idaho milkvetch)
Astragalus filipes Torr. ex A. Gray (basalt milkvetch)
Astragalus misellus S. Watson (pauper milkvetch)
Astragalus obscurus S. Watson (arcane milkvetch)
Trifolium dubium Sibth. (suckling clover)
GERANIACEAE (Geranium Family)
Erodium cicutarium (L.) L'Hér. ex Aiton (redstem stork's bill)
GROSSULARIACEAE (Gooseberry Family)

Ribes cereum Douglas (wax currant)

HYDRANGACEAE (Lilac Family)

Philadelphus lewisii Pursh (Lewis' mock orange)

HYDROPHYLLACEAE (Waterleaf Family)

Nama densum Lemmon (leafy nama)

Phacelia hastata Douglas ex Lehm. (silverleaf phacelia)

Phacelia heterophylla Pursh (varileaf phacelia)

Phacelia linearis (Pursh) Holz. (threadleaf phacelia)

LAMIACEAE (Mint Family)

Scutellaria nana A. Gray (dwarf skullcap)

ONAGRACEAE (Evening Primrose Family)

Camissonia contorta (Kearney) P.H. Raven (contorted-pod evening primrose)

Clarkia (clarkia)

Epilobium brachycarpum C. Presl (*E. paniculatum*) (tall annual willowherb)

Epilobium minutum Lindl. (chaparral willowherb)

OROBANCHACEAE (Broom-rape Family)

Orobanche uniflora L. var. *purpurea* (A. Heller) Achey (one-flowered broomrape)

POLEMONIACEAE (Phlox Family)

Collomia grandiflora Douglas ex Lindl. (grand collomia)

Gilia sinuata Douglas ex Benth. (rosy gilia)

Leptodactylon pungens (Torr.) Nutt. (granite prickly phlox)

Linanthus harknessii (Curran) Greene (Harkness' flaxflower)

Phlox cespitosa Nutt. (tufted phlox)

Phlox gracilis (Hook.) Greene (slender phlox)

Phlox hoodii Richardson (spiny phlox)

Polemonium micranthum Benth. (annual polemonium)

POLYGONACEAE (Buckwheat Family)

Eriogonum heracleoides Nutt. (parsnipflower buckwheat)

Eriogonum sphaerocephalum Douglas ex Benth.var. *sphaerocephalum (*rock buckwheat)

Eriogonum strictum Benth. var. *proliferum* (Torr. & A. Gray) C.L. Hitchc. (Blue Mountain buckwheat)

Eriogonum umbellatum Torr. (sulphur-flower buckwheat)

Eriogonum vimineum Douglas ex Benth. (wickerstem buckwheat)

PORTULACACEAE (Purslane Family)

Claytonia perfoliata Donn ex Willd. (miner's lettuce)

Claytonia sibirica L. (Siberian springbeauty)

RANUNCULACEAE (Buttercup Family)

Delphinium (larkspur)

ROSACEAE (Rose Family)

Amelanchier alnifolia (Nutt.) Nutt. ex M. Roem. (Saskatoon serviceberry)

Cercocarpus ledifolius Nutt. ex Torr. & A. Gray (mountain mahogany)

Holodiscus discolor (Pursh) Maxim. var. *dumosus* (glandular ocean-spray)

Potentilla glandulosa Lindl. (sticky cinquefoil)

Purshia tridentata (Pursh) DC. (bitterbrush)

RUBIACEAE (Madder Family)

Galium boreale L. (northern bedstraw)

Galium multiflorum Kellogg (shrubby bedstraw)

SAXIFRAGACEAE (Saxifrage Family)

Heuchera cylindrica Douglas ex Hook. (roundleaf alumroot)

Lithophragma glabrum Nutt. (smooth fringecup)

Lithophragma parviflorum (Hook.) Nutt. ex Torr. & A. Gray (small flowered fringecup)

SCROPHULARIACEAE (Figwort Family)

Castilleja applegatei Fernald (wavyleaf Indian paintbrush)

Collinsia parviflora Douglas ex Lindl. (maiden blue-eyed Mary)

Orthocarpus tenuifolius (Pursh) Benth. (thin leaved owl clover)

Penstemon deustus Douglas ex Lindl. (scabland penstemon)

Penstemon fruticosus (Pursh) Greene (bush penstemon)

Penstemon richardsonii Douglas ex Lindl. (cutleaf beardtongue)

Penstemon seorsus (A. Nelson) D.D. Keck (shortlobe penstemon)

Verbascum thapsus L. (common mullein)

VALERIANACEAE (Valerian Family)

Plectritis macrocera Torr. & A. Gray (longhorn plectritis)

Valeriana (valerian)

MONOCOTYLEDONS

LILIACEAE (Lily Family)

Allium douglasii Hook. (Douglas' onion)

Allium macrum S. Watson (rock onion)

Allium parvum Kellogg (small onion)

Calochortus macrocarpus Douglas (sagebrush mariposa lily)

Fritillaria pudica (Pursh) Spreng. (yellow fritillary)

Triteleia grandiflora Lindl. (largeflower triteleia)

Zigadenus venenosus S. Watson (meadow deathcamas)

POACEAE (Grass Family)

Achnatherum thurberianum (Piper) Barkworth (Thurber's needlegrass)

Bromus hordeaceus L. (soft brome)

Bromus rubens L. (red brome)

Bromus tectorum L. (cheatgrass)

Elymus elymoides (Raf.) Swezey (bottlebrush squirreltail)

Festuca idahoensis Elmer (Idaho fescue)

Koeleria macrantha (Ledeb.) Schult. (prairie Junegrass)

Leymus cinereus (Scribn. & Merr.) A. Löve (basin wildrye)

Poa bulbosa L. (bulbous bluegrass)

Poa secunda J. Presl (Sandberg bluegrass)

Pseudoroegneria spicata (Pursh) A. Löve (bluebunch wheatgrass)

Taeniatherum caput-medusae (L.) Nevski (medusahead wildrye)

Triticum aestivum L. (wheat)

Ventenata dubia (Leers) Coss. & Durieu (North Africa grass)

Vulpia microstachys (Nutt.) Munro ex Benth. (small fescue)

Vulpia octoflora (Walter) Rydb. (six-weeks fescue)

Ron Halvorson received a BS from California Polytechnic State University (San Luis Obispo) in 1971 and a MS from the University of Nevada, Reno, in 1974. He began his career in Prineville as a Range Conservationist with the BLM, serving in this capacity from 1974 through 1984. Since 1985 he has been natural resource specialist (District botanist), responsible for the district's special status plant and research natural area programs.

White Rock Fen

Barbara Raible
Salem District BLM, 1717 Fabry Rd. SE, Salem. OR 97306

The large central fen has a floating sphagnum mat. *Rhododendron macrophyllum* in the foreground. Photo by Barbara Raible.

As the crow flies, it is only 20 miles east of Lebanon, Oregon, but you will not doubt that you've left the beaten path when you reach these wetlands with floating sphagnum mats and bog-dwelling rarities like fetid adder's tongue and Willamette isopyrum. Here in the western Cascade Mountains, White Rock Fen Area of Critical Environmental Concern (ACEC) harbors four pristine wetlands in minor drainages north of White Rock Creek, a tributary in the Crabtree Watershed in the South Santiam Basin. The wetlands were discovered in 1983 by Salem BLM District personnel while doing a field survey. Nominated as an ACEC candidate in 1986, the designation was approved in the District Resource Management Plan in 1995 (BLM 1995). A primary zone around the wetlands is surrounded by a secondary protection zone, for a total of 54 acres (see map). Elevation ranges from 3,320 to 3,520 feet. The area has not been logged and remains essentially undisturbed.

White Rock Fen was designated as an ACEC to protect the four wetlands which make up the core area. The central wetland is the largest and contains a thick mat of sphagnum under an open tree canopy, with 2- to 10-foot wide channels of water meandering through it. A wet meadow and a shrubby area surround the central mat of sphagnum, with a mossy cliff and moist draw lying to the north. The two smaller wetlands that lie to the east and west of the central wetland have different water levels and correspondingly different vegetation. To the northeast, above BLM road 13.2, the northern-most wetland supports a small pool of open water with sphagnum banks. The entire area provides excellent opportunities for a variety of studies in palynology, sediments, sphagnum ecology, wetland development, and other biological and ecological research.

Plant Communities

Sphagnum wetlands provide specialized habitats for uncommon species. The floating sphagnum mat in the central wetland is particularly remarkable, and contains at least two species of sphagnum. Sphagnum is also present in the northern-most wetland. No sphagnum is visible in the other two wetlands, although it may be hidden beneath the other vegetation. In the mat, sphagnum mosses form a spongy turf where their upright stems crowd together to support each other. This growth pattern and specialized cells in sphagnum leaves and stems enables it to absorb and retain large quantities of water like a sponge. The sphagnum forms a living, saturated moss turf considerably higher than the original water level as it grows over a thick accumulation of dead sphagnum (peat).

Chester Novack, the district hydrologist, recorded a pH of 5.0 in the central wetland of the ACEC. This low (acid) pH, coupled with the abundance of sphagnum in floating mats and the primary influence of mineral-rich groundwater or pond water on the sphagnum formations, technically classifies White Rock Fen as a "poor fen" rather than a bog. In contrast, true bogs have lots of sphagnum but also have a raised or domed peat profile that isolates the vegetation from groundwater or pond water and limits the source of moisture to precipitation that is relatively mineral-poor compared to groundwater. There are no true bogs in Oregon, although fens and poor fens may contain localized hummocks of sphagnum and other vegetation that may be raised above the influence of groundwater (John Christy, pers. comm.). The acidity of water in poor fens and bogs is largely due to sphagnum removing metal cations from the water and leaving hydrogen ions as the predominant cation in solution.

The acidic environment of bogs and poor fens selects a distinctive assemblage of plants. Two species, round-leaved sundew (*Drosera rotundifolia*) and swamp cranberry (*Vaccinium oxycoccos* var. *intermedium*), have been identified in the central wetland. The

Close view of flower of fetid adder's tongue, with a fungus gnat. Photo by Aaron Liston.

Wetlands: Bogs, Fens and Poor Fens

Wetland ecosystems support water-loving (hydrophytic) plants. Soils are usually wet or damp much of the year and are typically saturated for two weeks or more during the growing season. Wetland nomenclature and classification vary widely depending on geography, purpose, or political system. No single naming system is widely accepted worldwide. In the United States, the US Army Corps of Engineers, the Environmental Protection Agency, the US Fish and Wildlife Service, and various state and local government agencies use various systems with similarities and differences.

General terms include marsh, bog, fen, mire, and swamp. Tidal flats, salt marshes, freshwater marshes, peat bogs, cranberry bogs, pocosins, moors, are specific terms for wetland types.

Fen, poor fen, and **bog** are used in this issue of *Kalmiopsis* to describe special wetlands found in several botanical areas. Although these terms have been defined in many different ways throughout the world, the terms here follow those in the recent US Environmental Protection Agency publication EPA 843-F-01-002b, *Types of Wetlands*, March 2002, available on line at http://www.epa.gov/owow/wetlands/facts/types_pr.pdf.

Whether the water, soil or substrate is acidic or alkaline greatly influences which plant species thrive in a given wetland. A **fen** is a wetland in which the water is alkaline to only slightly acid and has been in contact with mineral soil; the substrate is accumulated organic material derived primarily from graminoids (grasses, sedges, rushes) and bryophytes other than *Sphagnum*. Fens may be flat or sloping, including relatively steep slopes. A **bog** is a wetland in which the water is acidic and comes only from precipitation that is relatively mineral-poor compared to groundwater; the substrate is accumulated organic material derived primarily from *Sphagnum*, graminoids, and Ericaceous shrubs. Bogs may be flat or sloping and are characterized by a sphagnum peat layer that lifts the vegetation above contact with mineral-rich ground water. In Oregon, there are apparently no true bogs, and the acidic wetlands with sphagnum are classified as **poor fens**. The modifier comes from the relatively poor nutrient levels and acidic conditions. In western Oregon, certain species are indicators of acid substrates, such as *Drosera rotundifolia* and *Vaccinium oxycoccos*. Others, including *Darlingtonia californica* and *Gentiana setigera*, are commonly found in fens.

Peat refers to the amorphous or partially decomposed organic remains of plant materials found in a bog, fen, or other wetland. Peat found in bogs derives from *Sphagnum*, so it is acidic and has special characteristics related to the antiseptic properties of the moss. It is often used as an additive to make garden soils acid and improve their organic content. Peat formed from graminoid organic matter may not be acidic.

–Frank Lang and John Christy

Fetid adder's tongue (*Scoliopus hallii*). Photo by Charlene Simpson.

surrounding riparian zone supports fetid adder's tongue (*Scoliopus hallii*), a former BLM watch-listed species, and Hall's false rue anemone (*Enemion hallii*), a former BLM review-listed species.

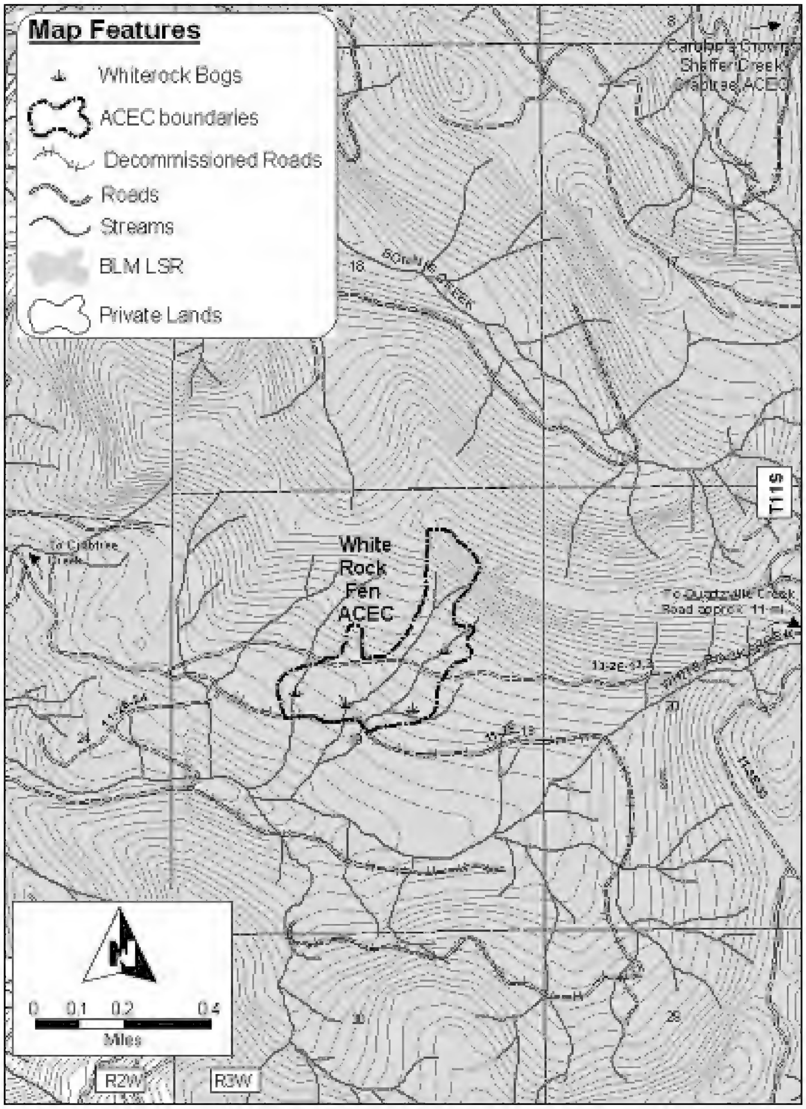
One of the more unusual flowering plants characteristic of poor fens in the western Cascades is round-leaved sundew, an insectivorous plant. Its leaves, concentrated in a basal rosette, are adapted for catching small insects. After the sticky, knobbed hairs on the upper surface and along the margins snare a victim, the longer hairs at the leaf edge slowly bend inward, and the prey is soon securely trapped. Glands on the hairs release enzymes that initiate digestion of the insect proteins, while other small glands on the leaf surface absorb the products of digestion. This insectivorous capability offsets one obstacle associated with living in a bog or poor fen, where nitrogen and other minerals are scarce. Sundew produces a few six-petaled white flowers, each about 1/4-inch across, on a stalk that forks once or twice. The flowers open for a relatively short time near midday and thus are likely to pass unnoticed.

Also at White Rock Fen is wild cranberry, a tiny shrub in the heath family whose trailing stems grow in tangled masses. Its leaves, mostly less than 3/8-inch long, are pointed at the tip. The nodding, deep pink flowers have four petals and are approximately 3/8-inch across when first open, before the petals turn up. The berries, ripening in late summer, are nearly round, generally less than 3/8-inch in diameter and bright red. The berries are edible and were very highly valued by the coastal Native Americans.

Many herbaceous plants such as boykinia, bittercress, sedges, bog orchids, and groundsel, surround the wetlands. On drier ground, bunchberry, willowherb, and foam flower appear interspersed with a shrub layer of rhododendron, thimbleberry, salmonberry, willows, slide alder, fool's huckleberry, and vine maple. This brushy area trends into a dense forest considered to be marginal for timber production. The western hemlock, western red cedar and Douglas fir are over 140 years old, but are short (100 ft.), small-diameter trees. With hundreds of trees per acre little sunlight reaches the ground, so understory vegetation is sparse, consisting of occasional beargrass and swordfern. Oxalis, lady ferns, and twinflower grow only in the riparian areas along the streams.

Soils, Geology and Climate

The soils found in White Rock Fen are predominately Crabtree stony loam with areas of Bensley and Valsetz stony loams (Langridge 1987). Crabtree soils are underlain by a strongly consolidated subsoil which can contribute to the presence of a perched water table two to three feet below the surface. Where the upper soil horizons have been removed, this water table intersects the ground surface, sometimes creating standing water.



Topographic map of White Rock Fen.

The surrounding dense forest of western red cedar, western hemlock and Douglas fir has a depauperate understory. Photo by Barbara Raible.

Formation of the wetlands here appears to be the result of ancient large-scale mass wasting (slumping/landslides) of the local ridge system, creating a system of landslide scarps and sag ponds. Highly permeable soil and shallow bedrock permit extensive lateral movement of subsurface water through this area. A rocky, boulder-strewn slope above the wetlands appears to provide the water source. No similar configuration of hydrological systems is known elsewhere on Salem District (Jim Fogg, BLM hydrologist, file report), although it is not uncommon elsewhere in landslide topography in the western Cascade Range (John Christy, pers. comm.). The three lower wetlands may have formed from what was at one time a single large wetland. The linear configuration of the lower wetlands and the large stair-stepped topography lend credence to this theory (C. Novak, 1988 file report).

Wildlife

The wetlands are visited by a variety of wildlife species seeking water. Signs of elk and deer as well as bear have been seen throughout the ACEC. Because the surrounding dense forest canopy has little forest floor vegetation, the open habitat around the bogs is well browsed. The water habitat attracts many insects and amphibians. Damsel and dragonflies can be seen flying over the central wetland, while giant Pacific salamanders and rough skinned newts swim in the channels.

Management

This ACEC is managed to permit natural processes to occur unhindered by overt human intervention. It is surrounded by land designated as Late Successional Reserve (LSR) under the Northwest Forest Plan. Because of the advanced ages of the surrounding forests this land is planned for retention as older forest habitat in the future. The site is monitored on an annual or bi-annual schedule to detect any unacceptable human use and to track the course of natural processes.

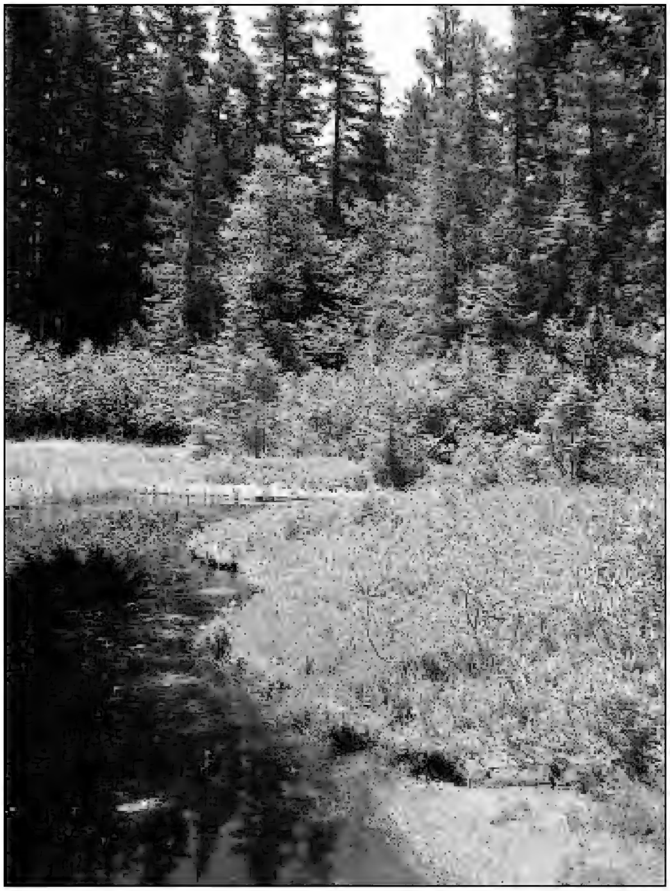
The natural succession of wetlands is to fill with sediment and change into meadows or other upland habitats. Shrubs are encroaching on the two smaller wetlands, and trees are beginning to fill in around the edges. Standing water is present only during winter and spring. As these are natural processes, no management actions will be taken to alter the outcome. It is not unusual for even larger pools and ponds to be dry by the end of summer during drought years (J. Christy, pers. comm.). Core sampling of sediments under the wetland would provide clues to the history of the site.

Visiting White Rock Fen

Few people visit White Rock Fen because the area is not easily accessed. Much of the route consists of narrow gravel roads not suitable for large or low clearance vehicles. Snow typically blocks roads from December to April and it is recommended that visitors contact the Salem BLM Office [503-375-5646; address above] for directions, a map, and current road conditions.

To find White Rock Fen, drive east on Highway 20 from Sweet Home for four miles, turn north on the Quartzville Access Road at the sign for Quartzville and Green Peter Reservoir. Follow this paved road 20.5 miles along Green Peter Reservoir and Quartzville Creek, which is a designated National Wild and Scenic River, then

The pond area of the central wetland was dry in 2003. Photo by Barbara Raible.



The central wetland normally has open water, bordered by a sphagnum mat with sundew. Moving out from this edge, one encounters bog cranberry, rushes, rhododendron, and finally a band of Sitka alder before entering the forest. Photo by Barbara Raible.

turn left onto Yellowstone Access Road, 11-3E-35.3. After 2.1 miles, keep left on Road 11-3E-26.1 for another 0.7 miles and then stay left again as the road becomes 11-3E-35.1 and drive 1.3 miles. Turn right on Road 11-3-27 and drive 2.9 miles, then turn right on Road 11-3E-33. Drive 3.3 miles, and turn left on 11-2E-13.2. Drive 1.6 miles and turn left onto the 11-2E-24. Continue 0.2 mile and park when you reach Road11-2E-19, which is blocked and has had the culverts removed. Walk along this ripped-up road, then go uphill at the first drainage (culvert has been pulled) to reach the first wetland. The largest wetland is uphill from the second drainage, but walking through the forest between the wetlands is fairly easy because of the lack of understory, although there is considerable downed wood. There is no drinking water, nor developed trails or facilities. Care should be taken with natural hazards, including downed trees across the animal trails and floating sphagnum mats at the edges of the wetlands, which are not solid footing.

Acknowledgments

The following individuals at the Salem District BLM contributed to the manuscript: Claire Hibler, botanist; Chester Novak and Jim Fogg, hydrologists; and Ellen Deehan, botanist in 1988. Frank A. Lang, Southern Oregon University professor emeritus, and John A. Christy, Oregon Natural Heritage Information Center, Oregon State University, provided clarification on bogs and fens.

References

[BLM] Bureau of Land Management. 1995. Salem District Resource Management Plan. Document on file at BLM Salem District office.

Langridge RW. 1987. Soil Survey of Linn County Area, Oregon. USDA Soil Conservation Service. 44 p.

Rigg GB. Sphagnum Moss in Mount Rainier Nat'l Park http://www.nps.gov/mora/notes/vol13-1d.htm-, *8-1 0* NPS. Mount Rainier Nature Notes. http://www.nps.gov/mora/notes/vol13-1d.htm#4. Accessed 2003 Sept 20.

NatureServe. 2003. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. http://www.natureserve.org/explorer. Accessed 2003 Sept 25.

[US EPA] Environmental Protection Agency. Wetlands: fens. http://www.epa.gov/owow/wetlands/types/fen.html. Accessed 2003 Sept 20.

Vascular Plant Species List

This non-comprehensive list was compiled by BLM botanist Claire Hibler. Nomenclature follows the checklist for the Oregon Flora Project.

FERNS AND THEIR ALLIES

BLECHNACEAE (Deer Fern Family)
Blechnum spicant (L.) Sm. (deer fern)
DENNSTAEDTIACEAE (Bracken Family)
Pteridium aquilinum (L.) Kuhn var. *pubescens* L. Underw. (bracken fern)
DRYOPTERIDACEAE (Wood Fern Family)
Athyrium filix-femina (L.) Roth var. *cyclosorum* Rupr. (northwestern lady fern)
Polystichum munitum (Kaulf.) C. Presl (western swordfern)
EQUISETACEAE (Horsetail Family)
Equisetum (horsetail)

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)
Thuja plicata D. Don (western red cedar)
PINACEAE (Pine Family)
Pinus monticola Douglas (western white pine)
Pseudotsuga menziesii (Mirbel) Franco var. *menziesii* (Douglas fir)
Tsuga heterophylla (Raf.) Sarg. (western hemlock)

DICOTYLEDONS

ACERACEAE (Maple Family)
Acer circinatum Pursh (vine maple)
APIACEAE (Carrot Family)
Cicuta douglasii (DC.) J. Coulter & Rose (western water hemlock)
Oenanthe sarmentosa J.S. Presl (Pacific water parsley)
ARALIACEAE (Ginseng Family)
Oplopanax horridus (Sm.) Miq. (devil's club)
ARISTOLOCHIACEAE (Birthwort Family)
Asarum caudatum Lindl. (wild ginger)
ASTERACEAE (Sunflower Family)
Lactuca muralis (L.) Fresen. (wall lettuce)

Senecio triangularis Hook. (bog groundsel)

BETULACEAE (Birch Family)

Alnus rubra Bong. (red alder)

Alnus viridis (Chaix) DC. ssp. *sinuata* (Regel) A. Löve & D. Löve (Sitka alder)

BRASSICACEAE (Mustard Family)

Cardamine (bittercress)

CAPRIFOLIACEAE (Honeysuckle Family)

Linnaea borealis L. var. *longiflora* Torr. (western twinflower)

CALLITRICHACEAE (Water-starwort Family)

Callitriche (water-starwort)

CORNACEAE (Dogwood Family)

Cornus unalaschkensis Ledeb. (bunchberry dogwood)

DROSERACEAE (Sundew Family)

Drosera rotundifolia L. (roundleaf sundew)

ERICACEAE (Heath Family)

Chimaphila umbellata (L.) W. Bartram (prince's pine)

Gaultheria ovatifolia A. Gray (Oregon wintergreen)

Gaultheria shallon Pursh (salal)

Ledum glandulosum Nutt. (western Labrador tea)

Menziesia ferruginea Smith (fool's huckleberry)

Rhododendron macrophyllum D. Don (Pacific rhododendron)

Vaccinium oxycoccos L. (swamp cranberry)

Vaccinium parvifolium Smith (red huckleberry)

Vaccinim uliginosum L. ssp. *occidentale* (bog blueberry)

GROSSULARIACEAE (Gooseberry Family)

Ribes bracteosum Douglas ex Hook. (stink currant)

HYDROPHYLLACEAE (Waterleaf Family)

Hydrophyllum tenuipes A. Heller (Pacific waterleaf)

HYPERICACEAE (St. John's Wort Family)

Hypericum anagalloides Cham. & Schltdl. (bog St. John's wort)

LAMIACEAE (Mint Family)

Mentha canadensis L. var. *canadensis* (L.) Kuntze (field mint)

MENYANTHACEAE (Buckbean Family)

Menyanthes trifoliata L. (buckbean, bogbean)

OLEACEAE (Ash Family)

Fraxinus latifolia Benth (Oregon ash)

ONAGRACEAE (Evening Primrose Family)

Epilobium ciliatum Raf. ssp. *glandulosum* (Lehm.) Hoch & Raven (purple leaved willow herb)

OXALIDACEAE (Oxalis Family)

Oxalis oregana Nutt. (redwood sorrel)

PRIMULACEAE (Primrose Family)

Trientalis latifolia Hook. (western starflower)

RANUNCULACEAE (Buttercup Family)

Caltha leptosepala D.C. (marshmarigold)

Enemion hallii (A. Gray) J.R. Drumm. & Hutch. (Willamette false rue anenome)

ROSACEAE (Rose Family)

Physocarpus capitatus (Pursh) Kuntze (Pacific ninebark)

Rubus parviflorus Nutt. (thimbleberry)

Rubus spectabilis Pursh. (salmonberry)

Spiraea douglasii Hook. (Douglas spiraea, hardhack)

RUBIACEAE (Madder Family)

Galium oreganum Britton (Oregon bedstraw)

Galium triflorum Michaux (sweetscented bedstraw)

SALICACEAE (Willow Family)

Salix (willow)

SAXIFRAGACEAE (Saxifrage Family)

Boykinia major A. Gray (mountain boykinia)

Boykinia occidentalis Torrey & A. Gray (coast boykinia)

Mitella ovalis Greene (coastal mitrewort)

Tiarella trifoliata var. *unifoliata* (Hook.) Kurtz (one leaf foamflower)

Tolmiea menziesii (Pursh) Torr. & A. Gray (piggyback plant)

SCROPHULARIACEAE (Figwort Family)

Mimulus guttatus DC (common monkeyflower)

VIOLACEAE (Violet Family)

Viola glabella Nutt. (stream violet)

MONOCOTYLEDONS

ARACEAE (Arum Family)

Lysichiton americanum Hultén & St. John (skunk cabbage)

CYPERACEAE (Sedge Family)

Carex (sedge)

Carex hendersonii Bailey (Henderson's sedge)

Scirpus (bulrush)

JUNCACEAE (Rush Family)

Juncus (rush)

Luzula parviflora (Ehrh.) Desv. (small flowered woodrush)

LILIACEAE (Lily Family)

Clintonia uniflora (Schult.) Kunth (beadlily)

Scoliopus hallii S. Watts. (fetid adder's tongue)

Triantha glutinosa (Michx.) Baker (sticky tofieldia)

Trillium ovatum Pursh (western trillium)

Xerophyllum tenax (Pursh) Nutt. (beargrass)

ORCHIDACEAE (Orchid Family)

Goodyera oblongifolia Raf. (rattlesnake plantain)

Platanthera dilatata (Pursh) Lindl. ex Beck var. *leucostachys* (Lindl.) Luer (white bog orchid)

Platanthera stricta Lindley (slender bog-orchid)

Listera (twayblade)

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Hunter Creek

Nancy J. Brian
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Imagine you can "apparate" (disappear from one place and reappear almost instantly in another, like the wizards and witches in the Harry Potter series) to the middle of Hunter Creek Bog. As you slowly sank into the bog, you'd find yourself surrounded by California pitcherplant, pleated and Mendocino gentians, Labrador tea, western tofieldia, California bog asphodel, sedges, Columbia and Vollmer's lilies, and Pacific reed grass. Outside of this watery jungle, you would see dry, bare, red rocky slopes and a scattering of Port Orford cedar and Jeffrey pine. Luckily, "muggles" (the non-magical community) don't need to "apparate" to get to Hunter Creek Bog. We can turn off Highway 101, just south of Gold Beach in Curry County, and drive east about 10.5 miles to visit this public land botanical jewel managed by the Bureau of Land Management (BLM).

ACEC Status

Jeffrey pine and Port Orford cedar surround a watery jungle of California pitcherplant in Hunter Creek Bog. Photo by Veva Stansell.

There are two Areas of Critical Environmental Concern (ACEC) at Hunter Creek: Hunter Creek Bog ACEC and the North Fork Hunter Creek ACEC, which together total about 2,300 acres. In 1982 the Kalmiopsis Audubon Society and the Innominata Garden Club nominated Hunter Creek Bog (Section 13) and Hunter Springs Bog (Section 24) for ACEC status (Bowen and others 1982). In 1994, 570 acres in those sections and 1,730 acres of North Fork Hunter Creek were proposed as a separate ACEC. In 1995, both ACEC proposals were designated, including lands located in Sections 1, 2, 11, 12, 13, 14, and 24, Township 37 South, Range 14 West (BLM 1995). The ACECs are bordered by Siskiyou National Forest land to the east and South Coast Lumber Company lands to the north, west, and south. The BLM is currently pursuing land acquisitions and exchanges to consolidate ownership, as provided in the final management plan (about 280 BLM acres in exchange for 320 South Coast Lumber acres). If the exchange is completed, the acquired lands will be included in the ACEC as public domain.

The Hunter Creek ACECs were designated for four natural resource values: 1) special status species, 2) natural systems and plant community, 3) fish and wildlife habitat, and 4) historic and cultural resources. Twelve special status plant species (see list at end of article) and five special status animal species are documented. No federally listed wildlife species have been found, but potential habitat is present for northern spotted owl, marbled murrelet, and American peregrine falcon. The North Fork of Hunter Creek is productive for resident trout and anadromous fish populations such as the fall chinook salmon and winter steelhead. Hunter Creek ACEC fills ecological and special species cells in the Oregon Natural

Ecological and special species cells identified in the 2003 Oregon Natural Heritage Plan for Hunter Creek ACECs

Ecoregion	Ecological Cell	Special Species Cell
Coast Range	• Port Orford cedar (*Chamaecyparis lawsoniana*) forest types on ultramafic soils	• Gasquet manzanita (*Arctostaphylos hispidula*)
Klamath Mountains	• California pitcherplant (*Darlingtonia californica*) fen on serpentine-peridotite, with Port Orford cedar • Coastal oak-conifer woodland and meadow mosaic	• Mendocino gentian (*Gentiana setigera*) and Siskiyou checkerbloom (*Sidalcea malviflora* ssp. *patula*) • Gasquet manzanita and Siskiyou trillium (*Trillium angustipetalum*)

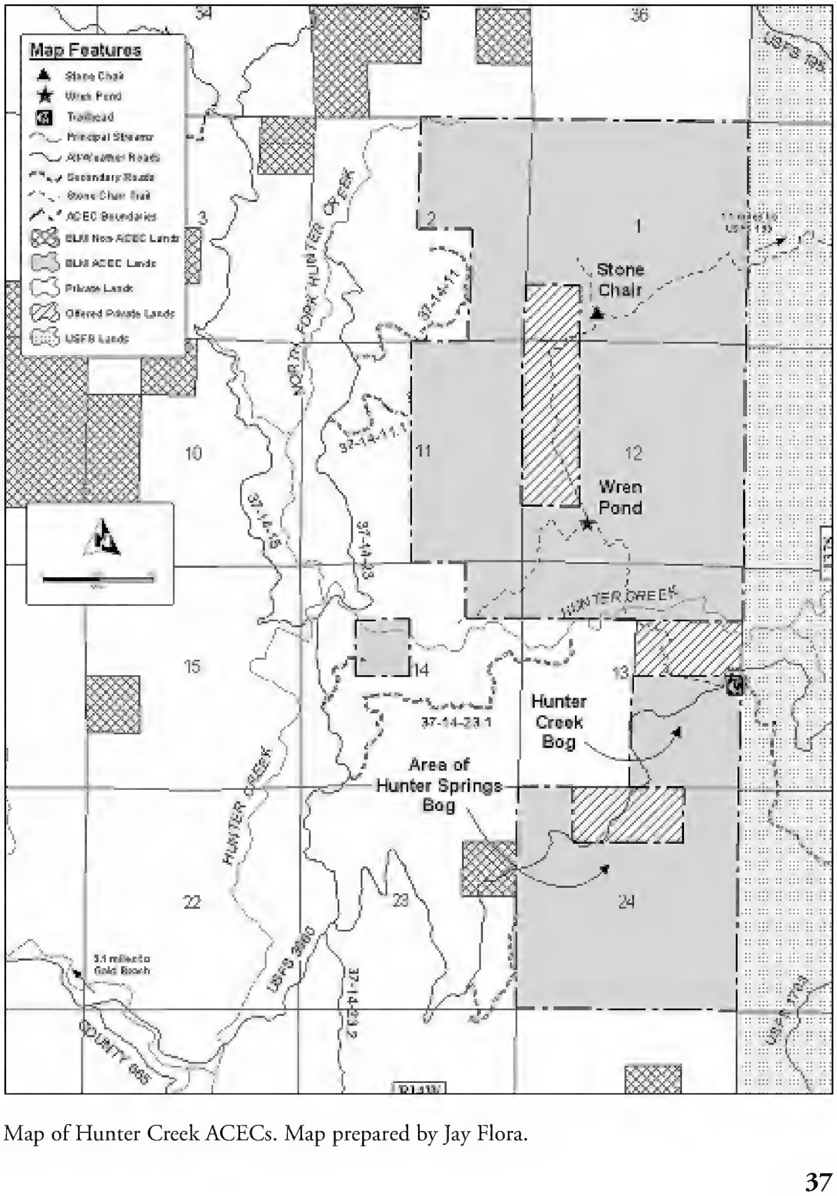
Heritage Plan for the Coast Range and Klamath Mountains Ecoregions (Allan and others 2001).

Because the Hunter Creek ACECs lie inland from the coastal fog belt zone, summer days are typically warm and sunny. Annual precipitation averages about 80 to 100 inches, primarily as rain falling between November and May. The elevation ranges from about 800 feet along the creek bottom to nearly 3,000 feet; transient snow falls above 2,500 feet elevation. In this maritime climate, the elevation gradient and geology provide habitat for mixed evergreen forest, rocky prairies, serpentine outcrops, fens, oak savannas, and riparian hardwood forests. It is unusual to find such extensive stands of Jeffrey pine, Oregon white oak, and rubber rabbitbrush (*Ericameria nauseosa* var. *speciosa*) only ten miles from the ocean. Hunter Creek Bog contains stands of Port Orford cedar. Unfortunately, the stand is infected with Port Orford cedar root rot (*Phytophthora lateralis*), a waterborne fungal root disease that may be transferred from one watershed to another by livestock, wildlife, recreationists, and motor vehicles. One can avoid spreading the spores by washing shoes and vehicle tires with a dilute solution of household chlorine bleach.

Hunter Creek and Hunter Springs Bogs

The Hunter Creek Bog ACEC contains three wetlands: one at Hunter Creek Bog and two at Hunter Springs Bog. The former, located in Section 13 and adjacent to USFS Road 3680, is most accessible. The site supports a multitude of hydric plants, including California pitcherplant, roundleaf sundew (*Drosera rotundifolia*), and Mendocino gentian, but no sphagnum moss. Jeffrey pine and Port Orford cedar grow on the upper slopes. Several small springs in the upper part of the basin drain into a central pond. The water has been found to be either acidic or alkaline, depending upon where the samples were taken. The reason why very few phytoplankton, periphyton, macroinvertebrates, and aquatic plants are present is not known. A year-round stream draining the pond exits through a culvert under the roadbed, flows down a rocky creek bed to the north, and empties into Hunter Creek. The pond is situated in a depression in an ancient landslide deposit, surrounded on the east, south, and west by scarps caused by movement of the slide material away from undisturbed ground of sedimentary rocks. The roadbed follows the northern or frontal portion of the landslide. A small area of non-ultramafic rocks sits in the center of the basin.

Access to Hunter Springs Bog is steeper and brushier than that



Map of Hunter Creek ACECs. Map prepared by Jay Flora.

California pitcherplant beneath a canopy of Jeffrey pine on the upper slopes of Hunter Creek Bog. Photo by Bruce Rittenhouse.

to Hunter Creek Bog. There are two spring areas, one each on the north- and south-facing sides of the ridge. California pitcherplant and roundleaf sundew are both present. The soils are deep and water movement is not as well defined as in Hunter Creek Bog (Bowen and others 1982).

The wetlands at Hunter Creek share the characteristics that define fens and bogs (see sidebar in the White Rock Fen article, on page 31). Technically, Hunter Creek Bog is a fen (John Christy, pers. comm.). It lacks sphagnum, the topography is sloping to flat, and there is contact with groundwater (seepage and the flowing stream). Bogs typically have a pH lower than 5.5, are dominated by sphagnum, and have raised hummocks or the entire peatland domed and elevated above the influence of groundwater so incoming moisture is limited to precipitation. An intermediate situation is called "poor fen" in places where pH is below 5.5 and topography is flat, but sphagnum is present (John Christy, pers. comm.). Thorough and systematic measurements of pH as well as conductivity data would be useful. Conductivity indirectly measures how mineral-rich the water is, fens being mineral-rich and bogs being mineral-poor.

North Fork Hunter Creek

North Fork Hunter Creek empties into Hunter Creek, which drains westward into the Pacific Ocean south of Gold Beach. Five vegetation types can be found adjacent to the North Fork. Along the ridges and upper slopes are open, park-like Jeffrey pine savannas with an understory of wildflowers and bunchgrasses, including onion-grasses (*Melica harfordii*, *M. spectabilis*, and *M. subulata*) and California oatgrass (*Danthonia californica*). An Oregon white oak (*Quercus garryana* var. *garryana*) savanna is also found on the open upper slopes.

The lower slopes are covered by a mixed conifer forest composed of western white pine, Douglas fir, Jeffrey pine, and Port Orford cedar with an understory of shrubs, including huckleberry oak (*Quercus vaccinifolia*), California coffeeberry (*Rhamnus californica* ssp. *occidentalis*), and red huckleberry (*Vaccinium parvifolium*). A successional scrubland of knobcone (*Pinus attenuata*) and lodgepole pine (*P. contorta*) covers areas that have burned in the last 50 years or where fires have burned repeatedly over time (Agee 1993). These fire-affected areas support an extremely dense understory of shrubs, including California coffeeberry, canyon live oak (*Quercus chrysolepis*), and tan oak (*Lithocarpus densiflorus* var. *densiflorus*). Along the streams one can walk through western sword fern (*Polystichum munitum*) shaded by Port Orford cedar, 200-year-old Douglas fir, and hardwoods such as red alder (*Alnus rubra*), bigleaf maple (*Acer macrophyllum*), Oregon myrtle (*Umbellularia californica*), and tanoak.

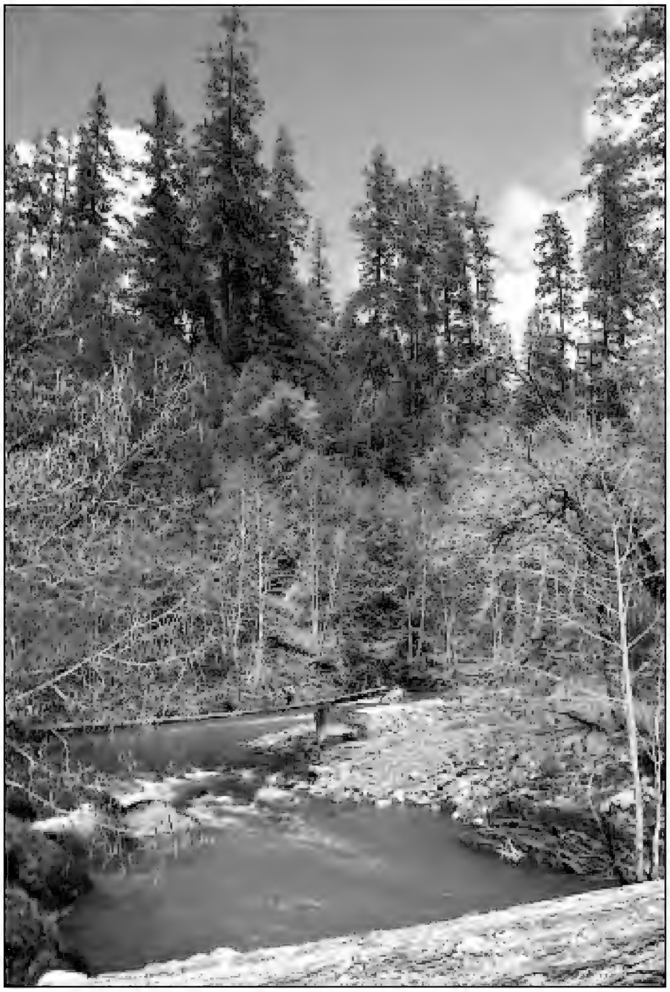
Botanical Gems

Seventy-three vascular plant families are represented in the Hunter Creek ACECs with a total of 327 species, of which 7% are non-native. (A species list follows the article.) The largest family is Asteraceae (35 species), followed by Poaceae (26 species).

Present are twelve special status vascular plant species (Oregon Natural Heritage Program (ONHP) 2001): Del Norte willow (*Salix delnortensis)*, Mendocino gentian, Siskiyou checkerboom, Siskiyou trillium, Bolander's onion (*Allium bolanderi*), Gasquet manzanita, serpentine sedge (*Carex serpenticula*), Bolander's hawkweed (*Hieracium bolanderi*), Piper's bluegrass (*Poa piperi*), California lady slipper (*Cypripedium californicum*), California pitcherplant, and pink fawnlily (*Erythronium revolutum*).

Other rare or uncommon plants to look for at Hunter Creek ACECs are Vollmer's lily (*Lilium pardalinum* ssp. *vollmeri*), serpentine phacelia (*Phacelia corymbosa*), Howell's bicuitroot (*Lomatium howellii*), roundleaf sundew, fringed pinesap

Mendocino gentian growing in Hunter Creek Bog. Photo by Veva Stansell.



Riparian woodland of Port Orford cedar, Douglas fir, red alder, bigleaf maple, California laurel, and tanoak along the North Fork of Hunter Creek. Photo by Veva Stansell.

(*Pleuricospora fimbriolata*), evergreen everlasting (*Antennaria suffrutescens*), brook wakerobin (*Trillium rivale*), fairy slipper (*Calypso bulbosa*), silky horkelia (*Horkelia sericata*), golden iris (*Iris innominata*), giant chainfern (*Woodwardia fimbriata*), Oregon fawnlily (*Erythronium oregonum*), Del Norte pea (*Lathyrus delnorticus*), and Scouler's woollyweed (*Hieracium scouleri*).

Surveys have found a total of 107 nonvascular species (26 lichens, 36 fungi, 14 liverworts, 1 hornwort, and 30 mosses) in the Hunter Creek ACECs (Wagner 2000, Clinch 2003, Mayor 2003). Two are special status species: the liverwort *Calypogeia sphagnicola* and the moss *Pseudoleskeella serpentinensis*. The present fungi list is incomplete because surveys were conducted during a dry fall when few fungi were fruiting. About 80% of our local fungi fruit only in the fall. Additional vascular and nonvascular species are likely to be added to the list when botanists survey more of the area. These lists are available online at http://www.npsoregon.org/lists/plantlists/hunter_creek.htm.

Serpentine Vegetation

Serpentine affiliated plants in the Hunter Creek ACECs include silky horkelia, Howell's biscuitroot, bigseed biscuitroot (*L. macrocarpum*), evergreen everlasting (*Antennaria suffrutescens*), leafy fleabane (*Erigeron foliosus* var. *confinis*), Jeffrey pine, knobcone pine, common beargrass (*Xerophyllum tenax*), Siskiyou bedstraw (*Galium ambiguum* ssp. *siskiyouense*), western azalea (*Rhododendron occidentale*), and California pitcherplant (Brooks 1987, Kruckeberg 1984a, b, Whittaker 1960). Additional ultramafic endemics include serpentine sedge (*Carex serpenticola*), serpentine arnica (*Arnica cernua*), redwood toothwort (*Cardamine nuttallii* var. *gemmata*), Piper's bluegrass, Del Norte willow, and wedgeleaf violet (*Viola cuneata*) (Zika and others 1998). Also, Jeffrey pine and Indian's dream (*Aspidotis densa*) generally indicate ultramafic substrates in southwestern Oregon.

Wildlife

Hunter Creek ACECs have five special status wildlife species (ONHP 2001): clouded salamander, mountain quail, red-legged frog, southern torrent salamander, and winter steelhead. Over 120 wildlife species are known or have potential habitat at Hunter Creek ACECs: 16 amphibians, 12 reptiles, 63 birds, 28 mammals, and 2 fish. The list includes black-tailed deer, Roosevelt elk, black bear, cougar, bobcat, fringed myotis, lump-nosed bat, red tree vole, ringtail cat, American marten, tailed frog, and California mountain king snake.

Soils and Geology

The streams entering Hunter Creek and Hunter Spring Bogs drain over rock that contains unusually high concentrations of magnesium and iron. This rock type is sometimes referred to as ultramafic rock, from *ultra* meaning high, and *mafic* (meaning composed of magnesium [*ma*gnesium] and iron [Latin *f*errum] + *ic*) (Kruckeberg

The Oregon white oak savanna of North Fork Hunter Creek is unusual in its proximity to the Pacific Ocean. Photo by Bruce Rittenhouse.

An open Jeffrey pine woodland with an understory of Piper's bluegrass (*Poa piperi*) on the upper slopes of North Fork Hunter Creek. Photo by Veva Stansell.

1984a, Brooks 1987). The ultramafic parent materials are serpentinite and its parent rock, periodotite. Serpentinite formed at the subduction zone of the continental plate when water released from the seafloor combined with the mantle rock (Bishop 2003). Serpentinite has a shiny green surface, polished under the pressure of slow, constant movement of continental plates. High in magnesium, but destitute of plant-sustaining elements such as potassium and sodium, serpentinite and perioditite zones support only meager vegetative cover.

The soils in the Hunter Creek ACECs are deep, fine, cobbly, silty, clay loams formed in materials weathered from serpentine and peridotite. Depth to bedrock is at least 40 inches. Serpentinite readily flakes apart and weathers to clay-sized particles, which are red from the oxidized iron. Thus, soils are reddish brown to red in color, and contain about 10 to 30 percent rock fragments. The soil in the bog is probably only a few feet deep. Though not described as a soil series, it is a black, poorly drained organic soil (histosol), influenced by the perched water table flowing over the ultramafic bedrock.

Human History

Cultural resources found within the Hunter Creek ACECs include a prehistoric stone tool manufacturing site on a ridge top near Hunter Creek Bog and a temporary campsite on a riverside bench near North Fork Hunter Creek (BLM 1996). When Europeans began exploring the region, Athapascan-speaking people called the Tututni lived there. The temporary camp site along North Fork Hunter Creek was probably where Tututni gathered and processed resources, such as acorns from Oregon white oak and roots of brodiaea and small camas. The main Tututni village was located on the Rogue River, about five miles to the north. Tututni people were killed, scattered, or removed to the Siletz Reservation following the Rogue Indian Wars (1855 and 1856). Today, the Confederated Tribes of Siletz Indians is the federally-recognized tribe for descendants of Tututni people.

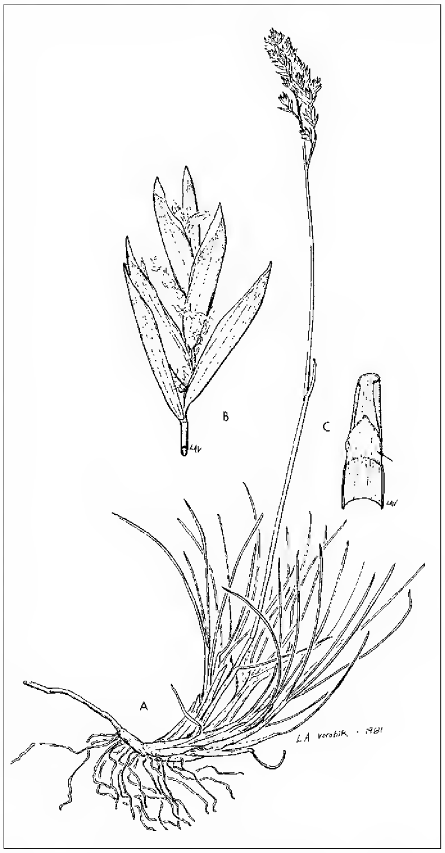
Signal Butte, a high point to the north of the ACEC on National Forest land, was named for the stone rings found on top that early pioneers believed were remnants of signal fire pits. Some think that the stone circles were spirit quest sites where young Tututni men fasted in seclusion for several days (Curtis 1924).

During the late 1800s and the early 1900s, homesteaders came to the North Fork Hunter Creek area. Two cabin locations are documented (BLM 1996). The Wren family built a cabin, grazed sheep and cattle, and dammed a small spring for livestock water, an impoundment now known as Wren Pond. Portions of several historic trails are still traceable, forming a network linking the homesteads along Hunter Creek to the Rogue River valley. The Crook family grazed sheep and cattle in the area until the 1960s. In past decades, trespass cattle have grazed the meadows and efforts are underway to remove them. McKinley Mine, located on the western slope of Signal Butte on National Forest land, is a copper, gold, silver and iron mine dating from the 1930s and 1940s. Other nearby chromite mines were also active during that time and during World War II.

Visiting Hunter Creek ACECs

Spring, summer, and early fall are good times to visit the Hunter Creek ACECs. South of Gold Beach, turn east near Milepost 331 on County Road 665, then right onto Hunter Creek Road. Follow the paved road for 4.9 miles, when it turns to dirt and is called USFS Road 3680. The dirt road crosses the Hunter Creek drainage. Continue west about 5.6 miles, up the mountain slope through an old clearcut. Past the top, a basin of bare red soil will catch your eye. If you'd like to see the Hunter Creek Bog, park at a pullout on the south side of the road. Rubber boots or waders are recommended to enter the bog, though you can observe it from the ridgeline to the west. The entry is made difficult by dense brush, but the interior is more open.

To visit the forested zones of North Fork of Hunter Creek you will need a day pack, good boots, a map, and plenty of time, as the area can be visited only on foot. The southern terminus of the



Piper's bluegrass is a dioecious, rhizomatous perennial found in serpentine forest openings. A, habit; B, spikelet; C, opened leaf sheath showing ligule. Illustration by Linda Ann Vorobik.

Stone Chair trailhead is located just past the Hunter Creek Bog, but it is difficult to find as it is unmarked. Easier access and the advantage of walking downhill from the highest point are gained via the northern terminus of the Stone Chair trail. The trail is named for rocks grouped in the shape of a chair. The unmarked trailhead is located off of USFS Road 195, approximately 6.4 miles past Hunter Creek Bog. The trail winds through the open Jeffrey pine forest. Hikers are eventually rewarded with distant views of the Pacific Ocean. Visitor etiquette calls for taking nothing but pictures and leaving nothing but footprints. Off-road vehicles are not permitted.

Lichen-covered rocks in the shape of a chair, for which the Stone Chair trail is named, sit in a California oatgrass opening among Jeffrey pine. Photo by Bruce Rittenhouse.

Acknowledgments

Thanks to Veva Stansell, Curry County botanist, Gold Beach, who kindly reviewed the manuscript, including the vascular plant species list, and loaned her photographs for this article. Bruce Rittenhouse, former Coos Bay District botanist, also reviewed the manuscript and contributed the remaining photographs. Jay Flora, Coos Bay Natural resource specialist (GIS), prepared the area map. Steven Samuels, Coos Bay District archeologist, provided review of the cultural and historical information. David Wagner reviewed the manuscript and the bryophyte list. Dan Luoma reviewed the fungi list. Frank A. Lang, Southern Oregon University professor emeritus, and John A. Christy, Oregon Natural Heritage Information Center, Oregon State University, provided clarification on bogs and fens.

References

Agee JK. 1993. Fire Ecology of Pacific Northwest Forests. Washington DC: Island Press. 493 p.

Allan S, Buckley AR, Meacham JE. 2001. Atlas of Oregon, 2nd ed. Eugene (OR): University of Oregon Press. 301 p.

Bishop EM. 2003. In Search of Ancient Oregon: a Geological and Natural History. Portland (OR): Timber Press. 288 p.

Bowen F, Hess R, Planeto H, Stansell V, Werschkul D. 1982. Hunter Creek and Springs Bogs: A proposal to the Coos Bay District of the Bureau of Land Management for an Area of Critical Environmental Concern by Kalmiopsis Audubon Society and Innominata Garden Club. Unpublished proposal on file at the BLM Coos Bay District office.

Brooks RR. 1987. Serpentine and its vegetation: a multidisciplinary approach. Portland (OR): Dioscorides Press. 454 p.

Clinch J. 2003. Purposive survey contract for lichens and bryophytes at Hunter Creek LSR (T37S, R14W, Sec 2). Unpublished report from Merlin Biological on file at BLM Coos Bay District office.

Curtis ES. 1924. The North American Indian: being a series of volumes picturing and describing the Indians of the United States and Alaska, Volume 13. Originally published by Edward S. Curtis; Frederick Webb Hodge, ed. 1970 edition by Johnson Reprint Corp., New York, NY. http://www.curtis-collection.com/tribe%20data/tolowa.html.

Kruckeberg AR. 1984a. California's serpentine. Fremontia 11:11-17.

Kruckeberg AR. 1984b. California serpentines: flora, vegetation, geology, soils, and management problems. Berkeley (CA): University of California Press. 180 p.

Mayor J. 2003. Preliminary Hunter Creek ACEC fungi species list. Purposive survey contract for fungi at Hunter Creek LSR (T37S, R14W, Sec 2) during December 5-6, 2002 and March 16-17, 2003. Unpublished report from Southern Oregon Environmental, Inc. on file at BLM Coos Bay District Office.

[ONHP] Oregon Natural Heritage Program. 2001. Rare, threatened, and endangered plants and animals of Oregon. Portland (OR): Oregon Natural Heritage Program. 94 p.

[OHNP] Oregon Natural Heritage Program. 2003. Oregon Natural Heritage Plan. Natural Heritage Advisory Council to the State Land Board. 142 p.

[USDA FS] Forest Service. 1997. West Fork Illinois River watershed analysis results. Iteration 1.0. Illinois Valley RD, Siskiyou NF.

[USDI BLM] Bureau of Land Management. 1996. Hunter Creek Bog and North Fork Hunter Creek Areas of Critical Environmental Concern Final Management Plan. North Bend (OR): BLM Coos Bay District. 46 p.

Wagner DH. 2000. Bryophytes of the Coos Bay District, USDI BLM Southwestern Oregon. Unpublished report on file at BLM Coos Bay District office. 153 p.

Whittaker RH. 1960. Vegetation of the Siskiyou mountains, Oregon and California. Ecol Monogr 30:279-338.

Zika PF, Wilson B, Otting N, Newhouse B, Lytjen D, Kuykendall K, Brainerd R. 1998. *Carex* (sedge) inventory of Coos Bay District, Bureau of Land Management. Unpublished report from Salix Associates and Carex Working Group on file at BLM Coos Bay District office.

The species lists for Hunter Creek Bog and North Fork Hunter Creek ACECs were compiled from the following sources: BLM (1996), Zika and others (1998), Forest Service (1997), and Veva Stansell. Nomenclature for vascular plants follows the checklist for the Oregon Flora Project. Names of taxa native to Oregon are printed in italic *Garamond*; alien taxa are in italic *Gill Sans*, a sans-serif type. The symbol * indicates Special Status Species and # indicates serpentine affiliate.

Vascular Plant Species List

FERNS AND THEIR ALLIES

BLECHNACEAE (Deer Fern Family)
Blechnum spicant (L.) Sm. (deer fern)
Woodwardia fimbriata Sm. (giant chainfern)
DENNSTAEDTIACEAE (Bracken Family)
Pteridium aquilinum (L.) Kuhn var. *pubescens* L. Underw. (bracken)
DRYOPTERIDACEAE (Wood Fern Family)
Athyrium filix-femina (L.) Mert. ssp. *cyclosorum* Rupr. (northwestern ladyfern)
Polystichum imbricans (D.C. Eaton) D.H. Wagner ssp. *imbricans* (narrowleaf swordfern)
Polystichum munitum (Kaulf.) C. Presl (western swordfern)
EQUISETACEAE (Horsetail Family)
Equisetum arvense L. (field horsetail)
Equisetum telmateia Ehrh. ssp. *braunii* (Milde) Milde (giant horsetail)
POLYPODIACEAE (Polypody Family)
Polypodium glycyrrhiza D.C. Eaton (licorice fern)
PTERIDACEAE (Brake Family)
Adiantum aleuticum (Rupr.) C.A. Paris (northern maidenhair fern)
Aspidotis densa (Brack.) Lellinger (podfern)
Cheilanthes gracillima D.C. Eaton (lace lipfern)
Pentagramma triangularis (Kaulf.) Yatsk., Windham, E. Wollenw. (goldback fern)
SELAGINELLACEAE (Spike-Moss Family)
Selaginella wallacei Hieron. (Wallace's spikemoss)

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)
Chamaecyparis lawsoniana (A. Murray bis) Parl. (Port Orford cedar)
Juniperus communis L. var. *saxatilis* Pall. (common juniper)
PINACEAE (Pine Family)
#*Pinus attenuata* Lemmon (knobcone pine)
Pinus contorta Douglas ex Loudon var. *contorta* (shore pine)
Pinus contorta Douglas ex Loudon var. *latifolia* Engelm. (lodgepole pine)
#*Pinus jeffreyi* Balf. (Jeffrey pine)
Pinus lambertiana Douglas (sugar pine)
#*Pinus monticola* D. Don (western white pine)
Pseudotsuga menziesii (Mirb.) Franco var. *menziesii* (Douglas fir)
Tsuga heterophylla (Raf.) Sarg. (western hemlock)
TAXACEAE (Yew Family)
Taxus brevifolia Nutt. (Pacific yew)

DICOTYLEDONS

ACERACEAE (Maple Family)
Acer circinatum Pursh (vine maple)
Acer macrophyllum Pursh (bigleaf maple)
ANACARDIACEAE (Sumac Family)
Toxicodendron diversilobum (Torr. & A. Gray) Greene (poison oak)
APIACEAE (Carrot Family)
Angelica arguta Nutt. (shining angelica)
Heracleum lanatum Michx. (cowparsnip)
Ligusticum apiifolium (Nutt.) A. Gray (celery leaved lovage)
Lomatium hallii (S. Watson) J.M. Coult. & Rose (Hall's biscuitroot)
#*Lomatium howellii* (S. Watson) Jeps. (Howell's biscuitroot)
#*Lomatium macrocarpum* (Nutt.) J.M. Coult. & Rose (bigseed biscuitroot)
Lomatium martindalei J.M. Coult. & Rose (cascade desertparsley)
Lomatium triternatum (Pursh) J.M. Coult. & Rose var. *triternatum* (nineleaf bisuitroot)
Lomatium utriculatum (Nutt.) J.M. Coult. & Rose (common lomatium)
Oenanthe sarmentosa C. Presl ex DC. (water parsley)
Osmorhiza berteroi DC. (sweetcicely)
Perideridia oregana (S. Watson) Mathias (squaw potato)
Sanicula bipinnatifida Dougl. ex Hook. (purple sanicle)
Sanicula crassicaulis Poepp. (Pacific snakeroot)
Sanicula laciniata Hook. & Arn. (coast snakeroot)
APOCYNACEAE (Dogbane Family)
Apocynum androsaemifolium L. (spreading dogbane)
ARALIACEAE (Ginseng Family)
Aralia californica S. Watson (elk clover)
ARISTOLOCHIACEAE (Birthwort Family)
Asarum caudatum Lindl. (wild ginger)
ASTERACEAE (Sunflower Family)
Achillea millefolium L. (common yarrow)
Adenocaulon bicolor Hook. (trailplant)
Anaphalis margaritacea (L.) Benth. & Hook. f. (pearly everlasting)
Anisocarpus madioides Nutt. (woodland madia)
#*Antennaria suffrutescens* Greene (evergreen everlasting)
#*Arnica cernua* Howell (serpentine arnica)
Arnica cordifolia Hook. (heartleaf arnica)
Baccharis pilularis DC. (coyotebrush)
Bellis perennis L. (lawndaisy)
Cirsium remotifolium (Hook.) DC. (fewleaf thistle)
Crepis pleurocarpa A. Gray (naked hawksbeard)
Crocidium multicaule Hook. (common spring-gold)
Ericameria nauseosa (Pall. ex Pursh) G.L. Nesom & G.I. Baird var. *speciosa* (Nutt.) G.L. Nesom & G.I. Baird (rubber rabbitbrush)
Erigeron eatonii A. Gray var. *plantagineus* (Greene) Cronquist (plantain leaved daisy)
#*Erigeron foliosus* Nutt. var. *confinus* (Howell) Jeps. (leafy fleabane)
Eriophyllum lanatum (Pursh) J. Forbes (common woolly sunflower)
Aster radulinus A, Gray (rough leaved aster)
Grindelia nana Nutt. (gumweed)
Hieracium albiflorum Hook. (white hawkweed)
*_Hieracium bolanderi_ A. Gray (Bolander's hawkweed)
Hieracium scouleri Hook. (Scouler's woollyweed)
Hypochaeris radicata L. (hairy catsear)
Lactuca saligna L. (willowleaf lettuce)
Leucanthemum maximum (Ramond) DC. (max chrysanthemum)
Luina hypoleuca Benth. (littleleaf silverback)
Micropus californicus Fisch. & C.A. Mey. (slender cottonweed)
Microseris laciniata (Hook.) Sch. Bip. ssp. *leptosepala* (Nutt.) K.L. Chambers (cutleaf silverpuffs)

Petasites frigidus (L.) Fr. var. *palmatus* (Aiton) Cronquist (arctic sweet coltsfoot)
Rudbeckia glaucescens Eastw. (waxy coneflower)
Senecio bolanderi A. Gray var. *bolanderi* (Bolander's groundsel)
Senecio canus Hook. (woolly groundsel)
Senecio jacobaea L. (stinking willie)
Senecio macounii Greene (Puget butterweed)
Senecio triangularis Hook. (arrowleaf ragwort)
Taraxacum officinale Weber ex F.H. Wigg. (common dandelion)

BERBERIDACEAE (Barberry Family)
Achlys triphylla (Sm.) DC. (vanillaleaf)
Berberis *aquifolium* Pursh (tall Oregon grape)
Berberis nervosa Pursh (Cascade Oregon grape)
Berberis repens Lindl. (creeping Oregon grape)
Vancouveria hexandra (Hook.) C. Morren & Decne. (white insideout flower)
Vancouveria planipetala Calloni (small insideout flower)

BETULACEAE (Birch Family)
Alnus rubra Bong. (red alder)
Corylus cornuta Marshall var. *californica* (A. DC.) W.M. Sharp (California hazelnut)

BORAGINACEAE (Borage Family)
Cynoglossum grande Douglas ex Lehm. (Pacific hound's tongue)
Myosotis discolor Pers. (yellow and blue scorpion grass)

BRASSICACEAE (Mustard Family)
#*Cardamine nuttalli* Greene var. *gemmata* (Greene) Rollins (redwood toothwort)
Streptanthus tortuosus Kellogg (mountain jewel flower)

CAMPANULACEAE (Harebell Family)
Campanula prenanthoides Durand (California harebell)

CAPRIFOLIACEAE (Honeysuckle Family)
Linnaea borealis L. var. *longiflora* Torr. (western twinflower)
Lonicera ciliosa (Pursh) Poir. ex DC. (orange honeysuckle)
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray (hairy honeysuckle)
Symphoricarpos albus (L.) S.F. Blake var. *laevigatus* Fernald (common snowberry)

CARYOPHYLLACEAE (Pink Family)
Cerastium arvense L. (field chickweed)
Moehringia macrophylla (Hook.) Fenzl (bigleaf sandwort)
Silene campanulata S. Watson ssp. *glandulosa* C.L. Hitchc. & Maguire (slender campion)
Silene gallica L. (windmill pink)

CONVOLVULACEAE (Morning Glory Family)
Calystegia atriplicifolia Hallier f. (nightblooming false bindweed)
Calystegia occidentalis (A. Gray) Brummitt (pale morning glory)

CRASSULACEAE (Stonecrop Family)
Sedum laxum (Britton) A. Berger ssp. *laxum* (rose flowered stonecrop)
Sedum spathulifolium Hook. (broadleaf stonecrop)

CUCURBITACEAE (Gourd Family)
Marah oreganus (Torr. & A. Gray) Howell (old man in the ground)

DROSERACEAE (Sundew Family)
Drosera rotundifolia L. (roundleaf sundew)

ERICACEAE (Heath Family)
Allotropa virgata Torr. & A. Gray ex A. Gray (sugar stick)
Arbutus menziesii Pursh (Pacific madrone)
Arctostaphylos columbiana Piper (hairy manzanita)
**Arctostaphylos hispidula* Howell (Gasquet manzanita)
#*Arctostaphylos nevadensis* A. Gray (pinemat manzanita)
Arctostaphylos uva-ursi (L.) Spreng. (kinnikinnick)
Chimaphila menziesii (R. Br.) Spreng. (little prince's pine)
Chimaphila umbellata (L.) W. Bartram (pipsissewa)
Gaultheria shallon Pursh (salal)
Ledum glandulosum Nutt. (western Labrador-tea)
Monotropa hypopitys L. (pinesap)
Pleuricospora fimbriolata A. Gray (fringed pinesap)
Pyrola picta Sm. (whiteveined wintergreen)
Rhododendron macrophyllum D. Don ex G. Don (Pacific rhododendron)
#*Rhododendron occidentale* (Torr. & A. Gray) A. Gray (western azalea)
Vaccinium ovatum Pursh (evergreen blueberry)
Vaccinium parvifolium Sm. (red huckleberry)

FABACEAE (Legume Family)
Lathyrus delnorticus C.L. Hitchc. (Del Norte pea)
Lathyrus nevadensis S. Watson var. *nevadensis* (Sierra pea)
Lotus formosissimus Greene (seaside lotus)
Lupinus bicolor Lindl. (minature lupine)
Lupinus sp. (lupine)
Medicago lupulina L. (black medic)
Pediomelum californicum (S. Wats.) Rydb. (California Indian breadroot)
Thermopsis gracilis Howell (golden pea)
Trifolium albopurpureum Torr. & A. Gray var. *dichotomum* (Hook. & Arn.) Isely (branched Indian clover)
Trifolium longipes Nutt. (longstock clover)
Trifolium subterraneum L. (subterranean clover)
Vicea americana Muhl. ex Willd. ssp. *americana* (American vetch)

FAGACEAE (Oak Family)
Chrysolepis chrysophylla (Douglas ex Hook.) Hjelmq. (golden chinquapin)
Lithocarpus densiflorus (Hook. & Arn.) Rehder var. *densiflorus* (tan oak)
#*Quercus chrysolepis* Liebm. (canyon live oak)
Quercus garryana Douglas ex Hook. var. *garryana* (Oregon white oak)
Quercus sadleriana R. Br. (deer oak)
Quercus vaccinifolia Kellogg (huckleberry oak)

FUMARIACEAE (Fumitory Family)
Dicentra formosa (Andrews) Walp. (Pacific bleeding heart)

GARRYACEAE (Silk Tassel Family)
Garrya buxifolia A. Gray (dwarf silktassel)
Garrya fremontii Torr. (bearbrush)

GENTIANACEAE (Gentian Family)
Gentiana affinis Griseb. (pleated gentian)
**Gentiana setigera* A. Gray (Mendocino gentian)

GROSSULARIACEAE (Gooseberry Family)
Ribes menziesii Pursh (coast prickly gooseberry)
Ribes roezlii Regel var. *cruentum* (Greene) Rehder (shinyleaf currant)
Ribes sanguineum Pursh (redflower currant)

HYDRANGEACEAE (Hydrangea Family)
Whipplea modesta Torr. (whipplevine)

HYDROPHYLLACEAE (Waterleaf Family)
Eriodictyon californicum (Hook. & Arn.) Torr. (yerba santa)
Nemophila menziesii Hook. & Arn. var. *atomaria* (Fisch. & C.A. Mey.) H.P. Chandler (baby blue eyes)
Nemophila parviflora Dougl. ex Benth. (smallflower nemophila)

Phacelia bolanderi A. Gray (Bolander's phacelia)
Phacelia corymbosa Jeps. (serpentine scorpionweed)
LAMIACEAE (Mint Family)
Prunella vulgaris L. (common selfheal)
Satureja douglasii (Benth.) Briq. (yerba buena)
LAURACEAE (Laurel Family)
Umbellularia californica (Hook. & Arn.) Nutt. (Oregon myrtle)
LINACEAE (Flax Family)
Linum bienne Mill. (pale flax)
MALVACEAE (Mallow Family)
**Sidalcea malviflora* (DC.) A. Gray ssp. *patula* C.L. Hitchc. (mallow sidalcea)
MYRICACEAE (Wax Myrtle Family)
Myrica californica Cham. & Schltdl. (Pacific wax myrtle)
OLEACEAE (Olive Family)
Fraxinus latifolia Benth. (Oregon ash)
ONAGRACEAE (Evening-Primrose Family)
Epilobium brachycarpum C. Presl (tall annual willowherb)
Epilobium minutum Lindl. (small flowered willowherb)
OROBANCHACEAE (Broom-Rape Family)
Boschniakia strobilacea A. Gray (California groundcone)
Orobanche uniflora L. (oneflowered broomrape)
OXALIDACEAE (Oxalis Family)
Oxalis oregana Nutt. ex Torr. & A. Gray (redwood sorrel)
Oxalis suksdorfii Trel. (Suksdorf's woodsorrel)
PARNASSIACEAE (Grass of Parnassus Family)
Parnassia californica (A. Gray) Greene (California grass of Parnassus)
PLANTAGINACEAE (Plantain Family)
Plantago lanceolata L. (narrowleaf plantain)
POLEMONIACEAE (Phlox Family)
Collomia heterophylla Hook. (variableleaf collomia)
Gilia capitata Sims (bluehead gilia)
Linanthus bicolor (Nutt.) Greene (bicolored linanthus)
Phlox diffusa Benth. (spreading phlox)
Phlox gracilis (Hook.) Greene (slender phlox)
POLYGALACEAE (Milkwort Family)
Polygala californica Nutt. (California milkwort)
POLYGONACEAE (Buckwheat Family)
Eriogonum ternatum Howell (ternate buckwheat)
Rumex acetosella L. (common sheep sorrel)
PORTULACACEAE (Purslane Family)
Claytonia sibirica L. (candy flower)
Montia parvifolia (Moç. ex DC.) Greene (littleleaf minerslettuce)
PRIMULACEAE (Primrose Family)
Dodecatheon hendersonii A. Gray (Henderson's shooting star)
Trientalis latifolia Hook. (broadleaf starflower)
RANUNCULACEAE (Buttercup Family)
Anemone oregana A. Gray (blue windflower)
Aquilegia formosa Fisch. ex DC. (western columbine)
Coptis laciniata A. Gray (Oregon goldthread)
Ranunculus aquatilis L. (whitewater crowfoot)
Ranunculus californicus Benth. (California buttercup)
Ranunculus occidentalis Nutt. (western buttercup)
RHAMNACEAE (Buckthorn Family)
#*Ceanothus pumilus* Greene (dwarf ceanothus)
Ceanothus thyrsiflorus Eschsch. (blueblossom)
Rhamnus californica Eschsch. ssp. *occidentalis* (Howell) C.B. Wolf (California coffeeberry)
Rhamnus purshiana DC. (cascara)
ROSACEAE (Rose Family)
Amelanchier alnifolia (Nutt.) Nutt. ex M. Roem. var. *semiintegrifolia* (Hook.) C.L. Hitchc. (Saskatoon serviceberry)
Aphanes arvensis L. (field parsley piert)
Fragaria vesca L. (woodland strawberry)
Fragaria virginiana Duchesne (Virginia strawberry)
Holodiscus discolor (Pursh) Maxim. (oceanspray)
#*Horkelia sericata* S. Watson (silky horkelia)
Physocarpus capitatus (Pursh) Kuntze (Pacific ninebark)
Rosa gymnocarpa Nutt. (dwarf rose)
Rubus leucodermis Douglas ex Torr. & A. Gray (western blackcap)
Rubus parviflorus Nutt. (thimbleberry)
Rubus spectabilis Pursh (salmonberry)
Rubus ursinus Cham. & Schltdl. (Pacific dewberry)
Sanguisorba officinalis L. (great burnet)
Spiraea douglasii Hook. (rose spirea)
RUBIACEAE (Madder Family)
#*Galium ambiguum* W. Wight var. *siskiyouense* Ferris (Siskiyou bedstraw)
Galium aparine L. (stickywilly)
Galium triflorum Michx. (fragrant bedstraw)
Sherardia arvensis L. (blue fieldmadder)
SALICACEAE (Willow Family)
**Salix delnortensis* C.K. Schneid. (Del Norte willow)
Salix sitchensis Sanson ex Bong. (Sitka willow)
SARRACENIACEAE (Pitcherplant Family)
#**Darlingtonia californica* Torr. (California pitcherplant)
SAXIFRAGACEAE (Saxifrage Family)
Boykinia occidentalis Torr. & A. Gray (coast boykinia)
Chrysosplenium glechomifolium Nutt. (Pacific golden saxifrage)
Mitella sp. (mitrewort)
Saxifraga howellii Greene (Howell's saxifrage)
Tolmiea menziesii (Pursh) Torr. & A. Gray (piggyback plant)
SCROPHULARIACEAE (Figwort Family)
Castilleja pruinosa Fernald (frosted paintbrush)
Collinsia grandiflora Douglas ex Lindl. (large flowered blue eyed Mary)
Collinsia rattanii A. Gray (sticky blue eyed Mary)
Digitalis purpurea L. (purple foxglove)
Mimulus guttatus DC. (seep monkeyflower)
Mimulus moschatus Douglas ex Lindl. (musk monkeyflower)
Penstemon anguineus Eastw. (Siskiyou beardtongue)
Penstemon azureus Benth. ssp. *azureus* (azure penstemon)
Penstemon laetus A. Gray (mountain blue penstemon)
Synthyris reniformis (Douglas ex Benth.) Benth. (snowqueen)
Triphysaria pusilla (Benth.) T.I. Chuang & Heckard (dwarf owl clover)
VALERIANACEAE (Valerian Family)
Plectritis ciliosa (E. Greene) Jeps. ssp. *ciliosa* (longspur seablush)
Plectritis congesta (Lindl.) DC. (shortspur seablush)
VIOLACEAE (Violet Family)
Viola adunca Sm. (hooked spur violet)
#*Viola cuneata* S. Watson (wedgeleaf violet)
Viola glabella Nutt. ex Torr. & A. Gray (pioneer violet)
Viola lanceolata L. (lance leaved violet)
Viola sempervirens Greene (redwoods violet)
VISCACEAE (Mistletoe Family)
Arceuthobium monticola Hawksw., Wiens & Nickrent (western white pine dwarf mistletoe)

Arceutobium siskiyouense Hawksw., Wiens & Nickrent (knobcone pine dwarf mistletoe)

MONOCOTYLEDONS

CYPERACEAE (Sedge Family)
Carex concinnoides Mack. (northwestern sedge)
Carex deweyana Schwein. ssp. *leptopoda* (Mack.) Calder & Roy L. Taylor (Dewey's sedge)
Carex echinata Murray (stellate sedge)
Carex hendersonii L.H. Bailey (Henderson's sedge)
Carex leptalea Wahlenb. (bristly stalked sedge)
Carex mendocinensis Olney (Mendocino sedge)
Carex obnupta L.H. Bailey (slough sedge)
Carex pachystachya Cham. ex Steud. (thick headed sedge)
Carex rossii W. Boott (Ross' sedge)
Carex scabriuscula Mack. (Cascade sedge)
#*Carex serpenticola* Zika (serpentine sedge)
Carex tumulicola Mack. (foothill sedge)
Scirpus criniger A. Gray (fringed cottongrass)
Scirpus sp. (bulrush)
IRIDACEAE (Iris Family)
Iris innominata L.F. Hend. (golden iris)
Iris tenax Douglas ex Lindl. (Oregon iris)
Sisyrinchium bellum S. Watson (beautiful blue eyed grass)
Sisyrinchium californicum (Ker Gawl.) Dryand. (golden eyed grass)
Sisyrinchium idahoense E.P. Bicknell (Idaho blue eyed grass)
JUNCACEAE (Rush Family)
Juncus bolanderi Engelm. (Bolander's rush)
Juncus effusus L. (common rush)
Juncus oxymeris Engelm. (pointed rush)
Juncus tenuis Willd. (slender rush)
Luzula comosa E. Mey. (Pacific woodrush)
LILIACEAE (Lily Family)
Allium amplectens Torr. (narrowleaf onion)
**Allium bolanderi* S. Watson var. *bolanderi* (Bolander's onion)
Allium bolanderi S. Watson var. *mirabile* (L.F. Hend.) McNeal (potato bulb Bolander's onion)
Allium siskiyouense Ownbey ex Traub (Siskiyou onion)
Allium validum S. Watson (swamp onion)
Brodiaea elegans Hoover (harvest brodiaea)
Calochortus tolmiei Hook. & Arn. (Oregon mariposa lily)
Camassia quamash (Pursh) Greene var. *quamash* (small camas)
Dichelostemma congestum (Sm.) Kunth (ookow)
Erythronium oregonum Applegate (Oregon fawnlily)
**Erythronium revolutum* Sm. (pink fawnlily)
Fritillaria affinis (Schult.) Sealy (checker lily)
Hastingsia alba (Durand) S. Watson (white rushlily)
Lilium columbianum Hanson (Columbia lily)
Lilium paradalinum Kellogg ssp. *vollmeri* (Eastw.) M.W. Skinner, ined. (Vollmer's lily)
Maianthemum racemosum (L.) Link ssp. *amplexicaule* (Nutt.) LaFrankie (western Solomon plume)
Maianthemum stellatum (L.) Link (starry false Solomon's seal)
Narthecium californicum Baker (bog asphodel)
Prosartes hookeri Torr. (Oregon fairybells)
Prosartes smithii (Hook.) Utech, Shinwari & Kawano (largeflower fairybells)
Triantha glutinosa (Michx.) Baker (sticky tofieldia)
**Trillium kurabayashii* J.D. Freeman (giant purple wakerobin)
Trillium ovatum Pursh (western trillium)
Trillium rivale S. Watson (brook wakerobin)
Triteleia bridgesii (S. Watson) Greene (Bridges' triteleia)
Triteleia hyacinthina (Lindl.) Greene (white brodiaea)
#*Xerophyllum tenax* (Pursh) Nutt. (beargrass)
Zigadenus micranthus Eastw. (smallflower death camas)
ORCHIDACEAE (Orchid Family)
Calypso bulbosa (L.) Oakes (fairy slipper)
Corallorhiza maculata (Raf.) Raf. (spotted coralroot)
Corallorhiza mertensiana Bong. (Pacific coralroot)
**Cypripedium californicum* A. Gray (California lady slipper)
Goodyera oblongifolia Raf. (western rattlesnake plantain)
Listera cordata (L.) R. Br. (heartleaf twayblade)
Piperia unalascensis (Spreng.) Rydb. (Alaska rein orchid)
Platanthera sparsiflora (S. Watson) Schltr. (sparse-flowered bog orchid)
POACEAE (Grass Family)
Achnatherum lemmonii (Vasey) Barkworth (Lemmon's needlegrass)
Aira caryophyllea L. (European silver hairgrass)
Anthoxanthum odoratum L. (sweet vernalgrass)
Bromus carinatus Hook. & Arn. (California brome)
Bromus vulgaris (Hook.) Shear (Columbia brome)
Calamagrostis nutkaensis (J. Presl) Steud. (Pacific reedgrass)
Cynosurus echinatus L. (hedgehog dogtail)
Dactylis glomerata L. (orchardgrass)
Danthonia californica Bol. (California oatgrass)
Deschampsia cespitosa (L.) P. Beauv. (tufted hairgrass)
Deschampsia elongata (Hook.) Munro (slender hairgrass)
Elymus glaucus Buckley (blue wildrye)
Festuca californica Vasey (California fescue)
Festuca idahoensis Elmer (Idaho fescue)
Festuca roemeri Yu.E. Alexeev (Roemer's fescue)
Festuca rubra L. (red fescue)
Hierochloe occidentalis Buckley (California sweetgrass)
Koeleria macrantha (Ledeb.) Schult. (prairie Junegrass)
Melica harfordii Bol. (Harford's oniongrass)
Melica spectabilis Scribn. (purple oniongrass)
Melica subulata (Griseb.) Scribn. (Alaska oniongrass)
**Poa piperi* Hitchc. (Piper's bluegrass)
Poa pratensis L. (Kentucky bluegrass)
Schedonorus phoenix (Scop.) Holub (tall fescue)
Trisetum canescens Buckley (tall trisetum)
Vulpia bromoides (L.) Gray (six weeks fescue)
POTAMOGETONACEAE (Pondweed Family)
Potamogeton sp. (pondweed)
TYPHACEAE (Cattail Family)
Typha latifolia L. (broadleaf cattail)

Nancy J. Brian has been the District Botanist for the Coos Bay District since 2001. Prior to that, she was the Botanist for Grand Canyon National Park.

French Flat

Mark Mousseaux
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Thomas Jefferson Howell was likely the first botanist to cast his plant-hungry eye upon French Flat, an area just north of the 1850s mining town of Waldo, Oregon (Kruckeberg and Ornduff 2003). Starting in 1884, Howell collected over 50 species from this local area, some of them type specimens. One hundred and twenty years later, you can follow Howell's footsteps at French Flat and enjoy most of the same species. Although financially impoverished in his lifetime, Howell left a rich legacy of botanical exploration. In tribute, several species from French Flat bear his name, including *Erythronium howellii*, *Isoetes howellii*, *Microseris howellii*, *Montia howellii*, and *Triteleia howellii*. In contrast, the two gold-hungry French Canadians for whom French Flat is named, J. Carron and J. Baptiste Desselles, extracted gold worth thousands of dollars, and left heaps of mining spoils as their legacy.

French Flat, located about six miles south of Cave Junction in Josephine County, was designated an Area of Critical Environmental Concern (ACEC) in 1995 for its outstanding botanical, geological, and ecological characteristics. It is best known in botanical circles for the largest population of Cook's desert parsley (*Lomatium cookii*) on federal lands. In 2002 the US Fish and Wildlife Service listed this species as federally endangered (USFWS 2002). The French Flat population is currently monitored by the Institute for Applied Ecology (Kaye 2003) under a Challenge Cost Share project with the BLM. Eleven rare plant species grow at French flat: Waldo rockcress (*Arabis aculeolata*), modest rockcress (*A. modesta*), Howell's fawnlily (*Erythronium howellii*), Siskiyou fritillary (*Fritillaria glauca*), opposite-leaved lewisia (*Lewisia oppositifolia*), slender meadowfoam (*Limnanthes gracilis* ssp. *gracilis*), Bolander's linanthus (*Linanthus bolanderi*), Howell's microseris (*Microseris howellii*), Douglas monkeyflower (*Mimulus douglasii*), Howell's spring beauty (*Montia howellii*), and Siskiyou butterweed (*Senecio hesperius*). Some of these species grow in large numbers at French Flat. [Ed. note: Descriptions of these species are found in *A Guide to Rare Plants of the Siskiyou National Forest*, Mullens 2000.]

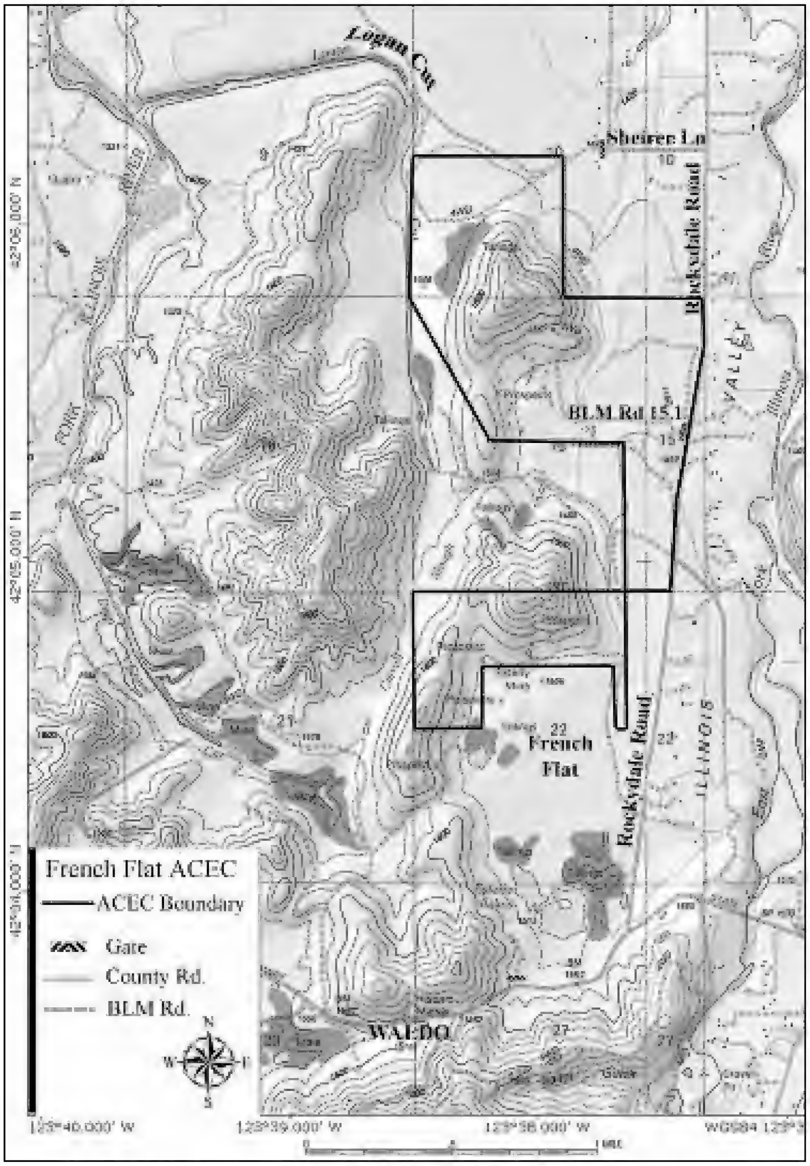
Ranging between 1450 and 1525 feet elevation, the rolling hills and flats of this gentle landscape lie between the east and west

Hope Mountain rises in the background southeast of French Flat. In the foreground, the serpentine-influenced flatlands are dominated by *Deschampsia cespitosa* and *Danthonia californica*, the primary plant community that supports extensive populations of *Lomatium cookii*. Photo by Tom Kaye, Institute for Applied Ecology.

forks of the Illinois River. Overall, the vegetation is composed of coniferous forests, mixed conifer/hardwood woodlands, and open grasslands, with a variety of shrubs in the forest communities. Some of its diverse vegetation types are influenced by serpentine parent materials, and several are considered rare or vulnerable by the Oregon Natural Heritage Program (Kagan 1993). French Flat ACEC also has important cultural, mineral and recreational values.

Montia howellii is a diminutive plant in the vernally wet meadows and forest openings at French Flat. Watch your step! Photo by Tom Kaye.

French Flat ACEC occupies 656 acres in Township 40 South, Range 8 West, sections 10, 15, and 22. The ACEC is surrounded by private and BLM lands. There are three public access points, all of which are gated to prevent motorized vehicle use. One access point is opposite the historic town of Waldo on Waldo Road, and the other two are off Rockydale Road (Sheirer Lane and BLM road 15.1). To reach the French Flat ACEC, drive south on the Redwood Highway (99) from Grants Pass, turning east at Cave Junction about ½ mile south of the intersection to the Oregon Caves and follow the Rockydale Road about 4 miles to Sheirer Lane. Alternatively, continue another mile south on Rockydale Road to BLM road 40-8-15.1 and turn right. To reach the ACEC from the south, continue south another 2.5 miles on Rockydale Road to Waldo Road. Turn right on Waldo Road; in one mile you reach the historic Waldo townsite; about a half mile later turn north on the primitive road. Park at any of the gates and walk in the short distance on old roads to explore the area on foot.



Vicinity map of French Flat ACEC. Prepared by Mabel Jankovsky-Jones.

Plant Communities

Five plant associations have been mapped in French Flat ACEC (Kaye 2002). Where possible, the descriptions that follow use nomenclature developed by Atzet and others (1996) to describe vegetation in southwestern Oregon, or are compared to types described by them. In addition to the five communities described here, there are areas of mine tailings that represent severe disturbance to soils and vegetation in the ACEC.

Douglas fir/dry shrub forest

These forests are typically dominated by Douglas fir (*Pseudotsuga menziesii*), with small amounts of ponderosa pine (*Pinus ponderosa*) and sugar pine (*P. lambertiana*). Hardwoods in the canopy or sub-canopy include Oregon white oak (*Quercus garryana*), California black oak (*Q. kelloggii*), Pacific madrone (*Arbutus menziesii*), and occasional tree-form tanoak (*Lithocarpus densiflorus*) and Pacific dogwood (*Cornus nuttallii*). The shrub layer in this community lacks dominance by any species, and ranges in total cover from 0 to 50%. Typical shrubs include California hazelnut (*Corylus cornuta*), poison oak (*Toxicodendron diversilobum*), deer brush (*Ceanothus integerrimus*), creeping snowberry (*Symphoricarpos mollis*), and

Lewisia oppositifolia, a beautiful white- to pink-flowered endemic to the Klamath Mountains, grows in the shallow soils of open rocky areas. Photo by Tom Kaye.

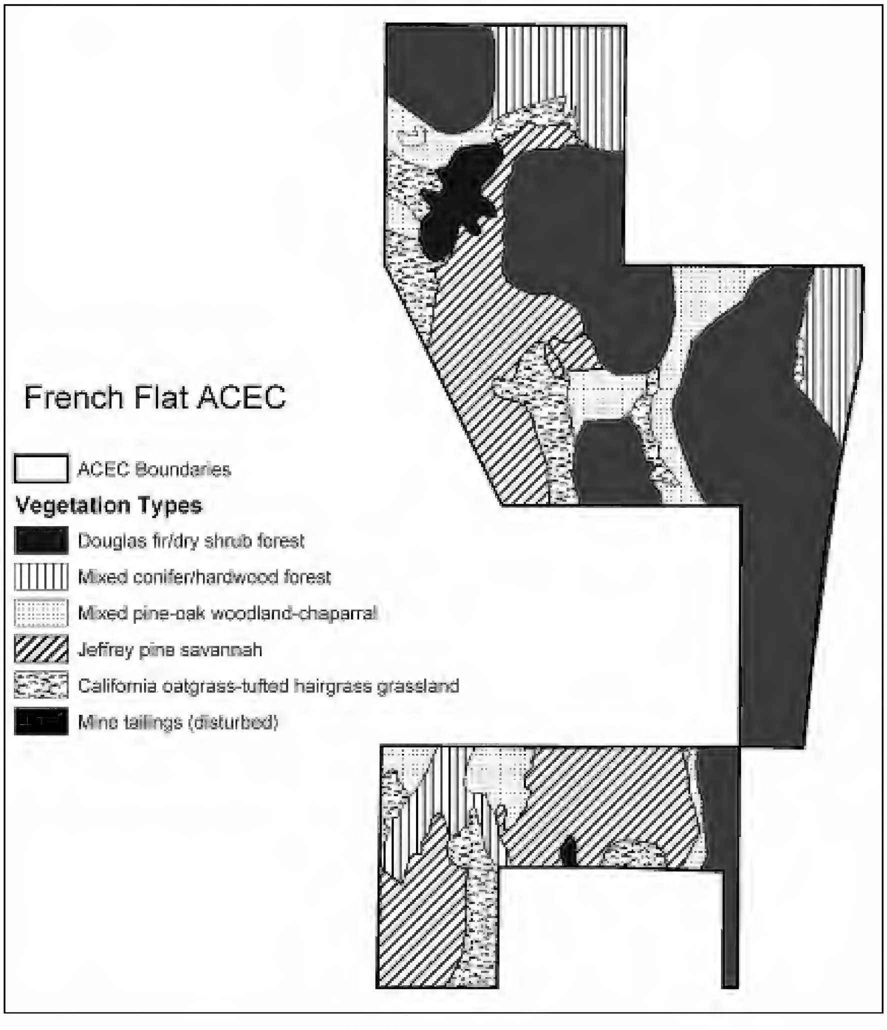
occasionally, tanoak, and whiteleaf manzanita (*Arctostaphylos viscida*). Understory herbs include Klamath arnica (*Arnica spathulata*), silvercrown (*Cacaliopsis nardosmia*), Siskiyou iris (*Iris bracteata*), western starflower (*Trientalis latifolia*), Henderson's shootingstar (*Dodecatheon hendersonii*), hairy and orange honeysuckle (*Lonicera hispidula, L. ciliosa*), Henderson's fawnlily, pipsissewa (*Chimaphila umbellata*), leafy peavine (*Lathyrus polyphyllus*), mountain sweet cicely (*Osmorhiza berteroi*), varied leaf collomia (*Collomia heterophylla*), golden pea (*Thermopsis rhombifolia* var. *montana*), blue wildrye (*Elymus glaucus*), false solomon's seal (*Maianthemum racemosum*), pathfinder (*Adenocaulon bicolor*), woodland tarweed (*Anisocarpus madioides*), and fairyslipper (*Calypso bulbosa*). Very similar to the Douglas fir/dry shrub community described by Atzet and others (1996), this community differs in lacking canyon live oak and including a greater diversity of shrubs, with tanoak in both shrub and tree forms. Rare plants in this community include Howell's fawnlily and mountain lady slipper (*Cypripedium montanum*).

Mixed conifer/ hardwood forest

Here, the forest canopy dominants include ponderosa pine, Douglas fir, California black and Oregon white oak and Pacific madrone, with scattered sugar pine. Total forest canopy ranges from 60 to 90% cover. The shrub layer is also represented by a diversity of species in patches or mixed groups, including wedgeleaf ceanothus (*Ceanothus cuneatus*), whiteleaf manzanita, poison oak, serviceberry (*Amelanchier alnifolia*), and scattered California hazelnut. Common herbs on the forest floor include Siskiyou iris, Henderson's shooting star, Pacific sanicle (*Sanicula crassicaulis*), woodland tarweed, Oregon mariposa lily (*Calochortus tolmiei*), Klamath arnica, soap plant (*Chlorogalum pomeridianum*), and Bolander's catchfly (*Silene hookeri* ssp. *bolanderi*). This community appears to be transitional between denser conifer forests and more open hardwood-dominated woodland chaparral. It is related to Atzet's Douglas fir/ponderosa pine/poison oak association, but contains more pines and hardwoods, and more dry-site shrubs such as wedgeleaf ceanothus and whiteleaf manzanita. Soils in this community appear to be little influenced by serpentine parent materials.

Mixed pine/oak woodland chaparral

Hardwoods and conifers mix in a variable canopy with abundant shrubs in this community type. Its open forest canopy (10 to 60% cover) distinguishes this from the previous community, and allows a greater shrub layer, ranging from 5 to 80% cover. The prominent woodland trees include ponderosa and Jeffrey pine, as well as black and Oregon white oak. Oregon ash (*Fraxinus latifolia*) and Douglas fir are also present, but at less than 5% each. The abundant shrubs are wedgeleaf ceanothus (average 30%), serviceberry, poison oak, and whiteleaf ceanothus, but arroyo willow (*Salix lasiolepis*), little wild rose (*Rosa gymnocarpa*), and small Oregon ash are also common. Herbaceous species include California oatgrass (*Danthonia californica*),


French Flat ACEC
ACEC Boundaries
Vegetation Types
Douglas fir/dry shrub forest
Mixed conifer/hardwood forest
Mixed pine-oak woodland-chaparral
Jeffrey pine savannah
California oatgrass-tufted hairgrass grassland
Mine tailings (disturbed)

Vegetation map of the French Flat ACEC. Prepared by Mabel Jankovsky-Jones.

naked desert parsley (*Lomatium nudicaule*), mallow sidalcea (*Sidalcea malviflora*), California fescue (*Festuca californica*), Sandberg bluegrass (*Poa secunda*), and soap plant. Serpentine parent materials evidently influence the soils under this community type, but apparently as mixed alluvium so the influence varies from weak to medium. This community type keys to a ponderosa pine-California black oak association in Atzet and others (1996), but has a different shrub component and occurs at lower elevations than those authors describe (1400 to 1600 vs. 3820 feet). Borgias (1991) referred to this community type at French Flat as *Pinus ponderosa-Quercus garryana-Q. kelloggii/Arctostaphylos viscida* woodland chaparral.

Calystegia californica grows on the serpentine-influenced soils of Jeffrey pine savannas. Photo by Tom Kaye.

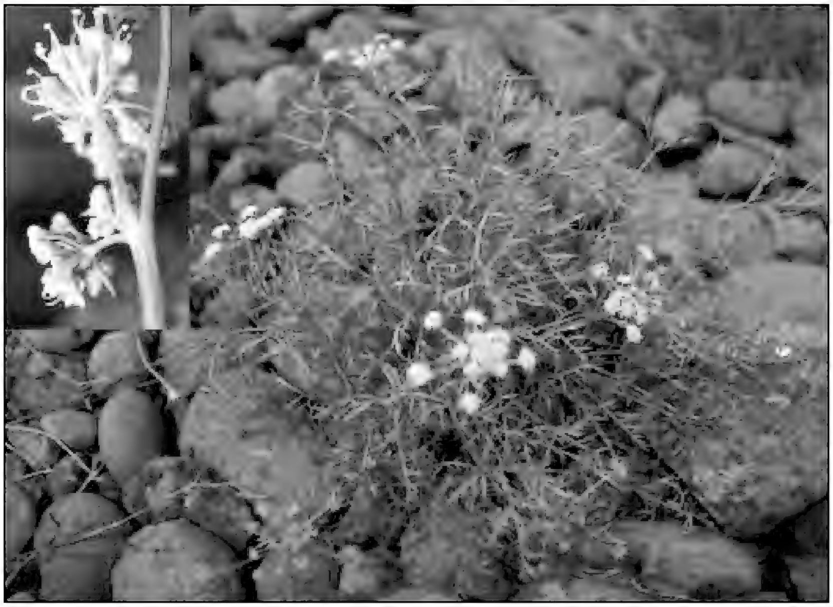
Erythronium howellii, an elegant lily with white to cream flowers, is endemic to open woods and forest edges on serpentine soils in southwestern Oregon and adjacent northern California. Photo by Tom Kaye.

Jeffrey pine savannah:
Jeffrey pine/buckbrush/Roemer's fescue

This plant association covers most of the serpentine slopes and is analogous to the Jeffrey pine/buckbrush/Idaho fescue community described by Atzet and others (1996). The widely scattered to locally clustered tree canopy ranges from 0 to 40% cover, and consists mainly of Jeffrey pine with an occasional incense cedar and Douglas fir. Pacific madrone, California black oak, and California white oak occur sporadically. The shrub layer is dominated by wedgeleaf ceanothus (0 to 70% cover) and Pacific madrone (0 to 50% cover), poison oak and serviceberry. The herbaceous layer is a rich assemblage of native grasses and forbs. The mixture and dominance of grasses is highly variable and diverse, including Oregon fescue (*Festuca roemeri*), Geyer's oniongrass (*Melica geyeri*), California oatgrass, California fescue, Lemmon's needlegrass (*Achnatherum lemmonii*), prairie junegrass (*Koeleria macrantha*) and Sandberg bluegrass. Oregon fescue tends to be more abundant on north facing slopes, Lemmon's needlegrass dominates drier south slopes, and Geyer's oniongrass tends to be most common on west-facing slopes. Total grass cover ranges from 10 to 75%. A diversity of forbs thrive in this community, including Oregon mariposa lily, Oregon sunshine (*Eriophyllum lanatum*), western buttercup (*Ranunculus occidentalis*), large fruited lomatium (*Lomatium macrocarpum*), naked desert parsley, sticky chickweed (*Cerastium glomeratum*), Indian's dream (*Aspidotis densa*), capitate gilia (*Gilia capitata*), variable leaf phacelia (*Phacelia heterophylla*), woolly-headed clover (*Trifolium eriocephalum*), large flowered blue eyed Mary (*Collinsia grandiflora*), Bolander's catchfly, pale morning glory (*Calystegia californica*), carrot-leaved horkelia (*Horkelia daucifolia*), sickle leaved onion (*Allium falcifolium*), and sensitive species such as Siskiyou butterweed, Howell's microseris, Douglas monkeyflower, opposite-leaved lewisia, and Waldo rockcress. This assemblage also includes some small patches (1 acre or less) of species mixes that could be recognized as Jeffrey pine-incense cedar/whiteleaf ceanothus, because of the localized absence of Oregon fescue and presence of sugar pine.

California oatgrass-tufted hairgrass grassland

This plant association occupies areas of serpentine alluvium at French Flat. The soils tend to be fine silts to clays, with cobbles and gravels mixed in on gentle slopes. Moisture levels in the soil appear to range from mesic to hydric. As indicated by the name, the dominant grasses are California oatgrass and tufted hairgrass, with the oatgrass dominating the mesic sites, and the hairgrass on the seasonally hydric soils. These grasslands are dotted by a few individuals of Jeffrey and ponderosa pine. The drier sites also host additional grass species, such as Geyer's oniongrass and Oregon fescue, which are also found in the Jeffrey pine savannah. The diverse assemblage of forbs includes shortstem mariposa (*Calochortus uniflorus*), Hall's violet (*Viola hallii*), common camas (*Camassia quamash*), California hesperochiron (*Hesperochiron californica*), Nuttall's quillwort (*Isoetes nuttallii*), common yarrow (*Achillea millefolium*), silver hairgrass (*Aira caryophyllea*), slender cottonweed (*Micropus californicus*), self-heal (*Prunella vulgaris*), and carrot-leaf horkelia. Rare species in this community include Cook's desert parsley and slender meadowfoam.


Lomatium cookii, a Federally endangered species, is distinguished by its simple, linear (or narrowly lanceolate) involucral bractlets. Photos courtesy of The Nature Conservancy, plant by Darren Borgias and insert showing bracts by Jim Post.

The Institute for Applied Ecology has monitored two sub-populations of Cook's desert parsley at French Flat since 1993. The total number of individuals increased from 1993 to 1998, but declined in 1999 and 2000, while the number of flowering plants has remained relatively stable. In 2002 the population remained stable in one of the sub-populations, but increased slightly in the other. Analysis of the 2003 monitoring data is forthcoming (http://www.appliedeco.org).

Noxious Weeds

Fortunately, only a few noxious weeds (e.g., *Centaurea pratensis* and *Hypericum perforatum*) as well as a few "obnoxious" ones (*Cirsium vulgare* and *Rubus armeniacus*) have invaded the French Flat ACEC, and they are limited to small scattered occurrences. The low numbers are partly due to the serpentine influence on the environment. However, several non-native grasses (*Bromus tectorum* and *Taeniatherum caput-medusae*) play a significant role, especially in meadows where there is less serpentine influence.

Human History

The vegetation of French Flat was likely shaped by the practices of the native Takilma Indians, primarily through their use of fire to manage food plants and vegetation for hunting and other resources. Although repeated burning of grasslands and woodlands for hunting and seed/acorn gathering were believed to be a common practice (Boyd 1999), no direct evidence of these practices has been documented for French Flat.

Euro-American activities during the past 150 years, such as land clearing, mining, fire suppression, and timber management, have changed the landscape of French Flat, allowing the invasion of annual grasses in perennial grasslands, pine trees in the meadows, Douglas fir in the pine-oak savannas, and an increase in tree and shrub densities in general. Historic and recent mining activities created rock tailing piles and other disturbed areas in the active mining claims. Areas within the ACEC were placer mined in the late 1800's and the National Register of Historic Places documents that $80,000 in gold was removed by the Frenchmen from the French Flat area. The Logan cut, a channel dug in 1886, was used until 1940 to provide water for hydraulic mining operations. The cut is 40 to 70 feet deep and runs along the western boundary of the north portion of the ACEC then west to the West Fork of the Illinois River a mile away. The significance of this cultural and hydrological feature has been recognized by its inclusion in the National Register of Historic Places, along with other sites representing the full range of historic mining activity in the Illinois Valley.

Minerals

French Flat ACEC has been prospected since 1852, and still has several mining claims, which are administered by the BLM. Minerals of interest in the ACEC include gold, platinum, and chromium. In contrast to historic disturbance, any future mining operations conducted within the ACEC must be in compliance with the 3809 Surface Management Regulations. These regulations require the miner to submit a Plan of Operations for any operations causing surface disturbance greater than casual use. In addition, all activities above casual use require a bond. The regulations require the miner to work with the BLM, providing the opportunity to institute mitigating measures that minimize disturbances to the resources for which the ACEC was established.

Recreation

Recreational opportunities include observation of the distinctive plant communities, spectacular and diverse wildflower viewing, bird watching, and hiking. The entire ACEC was closed to off-highway vehicles (OHVs) in June of 1992 (Federal register, Volume 57, No. 118). Unfortunately, some unauthorized OHV use continues, especially in open meadows in the spring. Non-destructive botanical forays into the ACEC are encouraged (bring your camera, not your plant press). The peak season for viewing wildflowers at French Flat is April through May.

References

Atzet T, White DE, McCrimmon LA, Martinez PA, Fong PR, Randall VD. 1996. Field Guide to the Forested Plant Associations of Southwestern Oregon. Portland (OR): USDA Forest Service Tech Paper R6-NR-ECOL-TP-17-96.

Boyd R. 1999. Indians, Fire, and the Land in the Pacific Northwest. Corvallis (OR): Oregon State University Press.

Borgias D. 1991. French Flat Natural Area Design. Unpublished report on file with The Nature Conservancy, Medford, Oregon.

Kagan J. 1993. Oregon Comprehensive Terrestrial Plant Community Classification. Unpublished document on file at the Oregon Natural Heritage Program, Portland, Oregon.

Kagan J. 1994. Habitat Management Plan for *Lomatium cookii* (Cook's desert-parsley) in the Illinois Valley, Josephine County, Oregon. Portland (OR): Oregon Natural Heritage Program.

Kaye TN. 2002. Vegetation Survey of French Flat ACEC. Unpublished report on file BLM Medford District office.

Kaye TN. 2003. *Lomatium cookii* population monitoring in the Illinois Valley, Josephine County, Oregon. Unpublished report on file BLM Medford District office.

Kruckeberg A. and Ornduff R. 2003. Thomas Jefferson Howell (1842-1912): the untutored, impoverished botanist. Oregon Flora Newsletter 9(2):9,12.

Mullens L. 2000. A Guide to Rare Plants of the Siskiyou National Forest. Grants Pass (OR): USDA Forest Service R6-11-084-00.

[USFWS] Fish and Wildlife Service. 2002. Final rule listing Cook's desert parsley as an Endangered Species. Federal Register 2002 Nov 7. 67 FR p 68003-68015.

Vascular Plant Species List

The list was compiled from site visits to the ACEC in 2001 and 2002 by Tom Kaye of the Institute for Applied Ecology, as well as various surveys by BLM staff, Darren Borgias of The Nature Conservancy, Jimmy Kagan of the Oregon Natural Heritage Program, and other individuals. [Ed. note: In this part of Oregon, identification of *Arctostaphylos* species can be difficult. Refer to Ken Chambers's article "Manzanitas–a study in speciation" in the Oregon Flora Newsletter 9(3):15-17.] Species that have special Federal or State status are noted by an asterisk before the scientific name. Nomenclature follows the Oregon Flora Project checklist. Names of taxa native to Oregon are printed in italic *Garamond*; alien taxa are in italic *Gill Sans*, a sans-serif type.

FERNS AND THEIR ALLIES

DENNSTAEDTIACEAE (Bracken Family)
Pteridium aquilinum (L.) Kuhn (western brackenfern)
DRYOPTERIDACEAE (Wood Fern Family)
Polystichum munitum (Kaulfuss) K. Presl (western swordfern)
PTERIDACEAE (Brake Family)
Aspidotis densa (Brack.) Lellinger (podfern)
ISOETACEAE (Quillwort Family)
Isoetes howellii Engelm. (Howell's quillwort)
Isoetes nuttallii A. Br. (Nuttall's quillwort)

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)
Calocedrus decurrens (Torr.) Florin (incense cedar)
PINACEAE (Pine Family)
Pinus jeffreyi Grev. & Balf. (Jeffrey pine)
Pinus lambertiana Dougl. (sugar pine)
Pinus ponderosa Douglas ex C. Lawson (ponderosa pine)
Pseudotsuga menziesii (Mirbel) Franco var. *menziesii* (Douglas fir)

DICOTYLEDONS

ANACARDIACEAE (Sumac Family)
Toxicodendron diversilobum (Torr. & Gray) Greene (Pacific poison oak)
APIACEAE (Carrot Family)
Daucus pusillus Michx. (American carrot)
Horkelia daucifolia (Greene) Rydb. (carrot-leaved horkelia)
*_Lomatium cookii_ Kagan (Cook's desert parsley)
Lomatium macrocarpum (Nutt.) J.M. Coult. & Rose (large fruited lomatium)
Lomatium nudicaule (Pursh) J.M. Coult. & Rose (naked desert parsley)
Lomatium triternatum (Pursh) J.M. Coult. & Rose (nineleaf biscuitroot)
Osmorhiza berteroi DC. (mountain sweet cicely)
Sanicula crassicaulis Poepp. var. *crassicaulis* (Pacific sanicle)
Sanicula bipinnatifida Douglas ex Hook. (purple sanicle)
ASTERACEAE (Sunflower Family)
Achillea millefolium L. (common yarrow)
Adenocaulon bicolor Hook. (pathfinder)
Agoseris heterophylla (Nutt.) Greene (annual agoseris)
Anisocarpus madioides Nutt. (woodland tarweed)
Arnica spathulata Greene (Klamath arnica)
Centaurea x pratensis Thuill. (meadow knapweed)
Cirsium vulgare (Savi) Ten. (bull thistle)
Crepis (hawksbeard)
Eriophyllum lanatum (Pursh) J. Forbes (Oregon sunshine)
Hieracium albiflorum Hook. (white-flowered hawkweed)
Hypochaeris radicata L. (hairy cat's ears)
Cacaliopsis nardosmia (A. Gray) A. Gray ssp. *nardosmia* (sivercrown)
Madia exigua (Sm.) A. Gray (little tarweed)
Micropus californicus Fisch. & C.A. Mey. (slender cottonweed)
*_Microseris howellii_ A. Gray (Howell's microseris)
*_Senecio hesperius_ Greene (Siskiyou butterweed)
Senecio macounii Greene (Puget butterweed)
Wyethia angustifolia (DC.) Nutt. (narrow leaved mule's ears)

BETULACEAE (Birch Family)
Corylus cornuta Marshall var. *californica* (A. DC.) W.M. Sharp (hazelnut)
BRASSICACEAE (Mustard Family)
**Arabis aculeolata* Greene (Waldo rockcress)
Arabis holboellii Hornem var. *retrofracta* (Graham) Rydb. (second rockcress)
**Arabis modesta* Rollins (modest rockcress)
Cardamine nuttallii Greene var. *gemmata* (Greene) Rollins (redwood toothwort)
Draba verna L. (vernal whitlow-grass)
Lepidium campestre (L.) R. Br. (field cress)
Thysanocarpus curvipes Hook. (fringepod)
BORAGINACEAE (Borage Family)
Cryptantha intermedia (A. Gray) Greene (common cryptantha)
Cynoglossum grande Douglas ex Lehm. (Pacific hound's tongue)
Pectocarya setosa A. Gray (bristly combseed)
CAMPANULACEAE (Harebell Family)
Campanula scouleri Hook. ex A. DC. (Scouler's bellflower)
Downingia elegans (Douglas ex Lindl.) Torr. (elegant downingia)
Githopsis specularioides Nutt. (common blue cup)
CAPRIFOLIACEAE (Honeysuckle Family)
Lonicera ciliosa (Pursh) Poir. ex DC. (orange honeysuckle)
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray (hairy honeysuckle)
Symphoricarpos albus (L.) S.F. Blake (common snowberry)
Symphoricarpos mollis Nutt. (creeping snowberry)
CARYOPHYLLACEAE (Pink Family)
Cerastium glomeratum Thuill. (sticky chickweed)
Minuartia douglasii (Fenzl ex Torr. & A. Gray) Mattf. (Douglas sandwort)
Silene hookeri Nutt. ssp. *bolanderi* (A. Gray) Abrams (Bolander's catchfly)
CONVOLVULACEAE (Morning-glory Family)
Calystegia occidentalis (A. Gray) Brummitt ssp. *occidentalis* (pale morning glory)
CORNACEAE (Dogwood Family)
Cornus nuttallii Audubon ex Torr. & A. Gray (Pacific dogwood)
ERICACEAE (Heath Family)
Arbutus menziesii Pursh (Pacific madrone)
Arctostaphylos columbiana Piper (hairy manzanita)
Arctostaphylos viscida Parry (whiteleaf manzanita)
Chimaphila umbellata (L.) W. Bartram (pipsissewa)
FABACEAE (Legume Family)
Lathyrus polyphyllus Nutt. (leafy peavine)
Lotus corniculatus L. (bird's foot trefoil)
Lotus oblongifolius (Benth.) Greene (Torrey's lotus)
Lotus purshianus Clem. & E.G. Clem. (Spanish clover)
Thermopsis rhombifolia (Nutt. ex Pursh) Nutt. ex Richardson var. *montana* (Nutt. ex Torr. & A. Gray) Isely (golden pea)
Trifolium dubium Sibth. (least hop clover)
Trifolium eriocephalum Nutt. (woolly-headed clover)
Trifolium variegatum Nutt. (white tip clover)
Vicia americana Muhl. ex Willd. (American vetch)
FAGACEAE (Oak Family)
Lithocarpus densiflorus (Hook. & Arn.) Rehder (tanoak)
Quercus garryana Douglas ex Hook. var. *garryana* (Oregon white oak)
Quercus garryana Douglas ex Hook. var. *breweri* (Engelm.) Jeps. (Brewer oak)
Quercus kelloggii Newb. (California black oak)
GERANIACEAE (Geranium Family)
Erodium cicutarium (L.) L'Hér. ex Aiton (redstem filaree)
HYDROPHYLLACEAE (Waterleaf Family)
Hesperochiron californicus (Benth.) S. Watson (California hesperochiron)
Nemophila pedunculata Douglas ex Benth. (spreading nemophila)
Phacelia heterophylla Pursh (variable leaf phacelia)
HYPERICACEAE (St. John's wort Family)
Hypericum perforatum L. (St. Johnswort)
LAMIACEAE (Mint Family)
Prunella vulgaris L. (self-heal)
Satureja douglasii (Benth.) Briq. (yerba buena)
LIMNANTHACEAE (Meadowfoam Family)
**Limnanthes gracilis* Howell ssp. *gracilis* (slender meadowfoam)
MALVACEAE (Mallow Family)
Sidalcea malviflora (DC.) A. Gray ssp. *elegans* (Greene) C.L. Hitchc. (mallow sidalcea)
OLEACEAE (Olive Family)
Fraxinus latifolia Benth. (Oregon ash)
ONAGRACEAE (Evening Primrose Family)
Clarkia gracilis (Piper) A. Nelson & J.F. Macbr. (slender godetia)
Epilobium brachycarpum J. Presl (tall annual willowherb)
Epilobium rigidum Hausskn. (rigid willow herb)
OROBANCHACEAE (Broom-rape Family)
Orobanche uniflora L. (naked broomrape)
PLANTAGINACEAE (Plantain Family)
Plantago lanceolata L. (English plantain)
POLEMONIACEAE (Pink Family)
Collomia heterophylla Hook. (varied leaf collomia)
Gilia capitata Sims (capitate gilia)
**Linanthus bolanderi* (A. Gray) Greene (Bolander's linanthus)
Linanthus bicolor (Nutt.) Greene (bicolored linanthus)
Navarretia intertexta (Benth.) Hook. (needle-leaved navarretia)
Phlox speciosa Pursh (showy phlox)
POLYGALACEAE (Milkwort Family)
Polygala californica Nutt. (California milkwort)
POLYGONACEAE (Buckwheat Family)
Eriogonum nudum Douglas ex Benth. (naked buckwheat)
Rumex acetosella L. (sheep sorrel)
Rumex crispus L. (curlyleaf dock)
PORTULACACEAE (Purslane Family)
Calandrinia ciliata (Ruíz & Pav.) DC. (red maids)
Claytonia exigua Torr. & A. Gray (pale springbeauty)
Claytonia perfoliata Donn ex Willd. (miner's lettuce)
**Lewisia oppositifolia* (S. Watson) B.L. Rob. (opposite leaved lewisia)
Montia fontana L. (water chickweed)
Montia linearis (Douglas ex Hook.) Greene (narrow leaved montia)
**Montia howellii* S. Watson (Howell's springbeauty)
PRIMULACEAE (Primrose Family)
Dodecatheon hendersonii A. Gray (Henderson's shootingstar)
Trientalis latifolia Hook. (western starflower)
RANUNCULACEAE (Buttercup Family)
Ranunculus occidentalis Nutt. (western buttercup)

RHAMNACEAE (Buckthorn Family)
Ceanothus cuneatus (Hook.) Nutt. ex Torr. & A. Gray (buckbrush, wedgeleaf ceanothus)
Ceanothus integerrimus Hook. & Arn. (deer brush)
Ceanothus pumilus Greene (Siskiyou mat)
ROSACEAE (Rose Family)
Amelanchier alnifolia (Nutt.) Nutt. ex M. Roem. (serviceberry)
Potentilla glandulosa Lindl. (sticky cinquefoil)
Potentilla gracilis Douglas ex Hook. (slender cinquefoil)
Prunus subcordata Benth. (western plum)
Rosa gymnocarpa Nutt. (little wild rose)
Rubus armeniacus Focke (Himalayan blackberry)
Rubus laciniatus Willd. (cut leaf blackberry)
RUBIACEAE (Madder Family)
Galium aparine L. (cleavers)
SALICACEAE (Willow Family)
Salix lasiolepis Benth. (arroyo willow)
SAXIFRAGACEAE (Saxifrage Family)
Lithophragma parviflorum (Hook.) Nutt. ex Torr. & A. Gray (small flowered fringe cup)
Saxifraga (saxifrage)
SCROPHULARIACEAE (Figwort Family)
Castilleja rubicundula (Jeps.) T.I. Chuang & Heckard ssp. *lithospermoides* (Benth.) T.I. Chuang & Heckard (gromwell paintbrush)
Collinsia grandiflora Douglas ex Lindl. (large flowered blue eyed Mary)
Collinsia parviflora Douglas ex Lindl. (small flowered blue eyed Mary)
Mimulus guttatus DC. (common monkeyflower)
*_Mimulus douglasii_ (Benth.) A. Gray (Douglas monkeyflower)
Triphysaria pusilla (Benth.) T.I. Chuang & Heckard (dwarf owl clover)
Tonella tenella (Benth.) A. Heller (small flowered tonella)
Veronica (veronica)
VALERIANACEAE (Valerian Family)
Plectritis congesta (Lindl.) DC. (rosy plectritis)
VIOLACEAE (Violet Family)
Viola adunca Sm. (western long spurred violet)
Viola glabella Nutt. ex Torr. & A. Gray (smooth woodland violet)
Viola hallii A. Gray (Hall's violet)
Viola lobata Benth. (Lobed-leaf violet)

MONOCOTYLEDONS

CYPERACEAE (Sedge Family)
Carex deweyana Schwein. (Dewey's sedge)
Carex lenticularis Michx. (lens-shaped sedge)
Carex mendocinensis Olney (Mendocino sedge)
Carex multicaulis L.H. Bailey (many stemmed sedge)
Carex obnupta L.H. Bailey (slough sedge)
Carex nudata W. Boott (torrent sedge)
Carex praegracilis W. Boott (clustered field sedge)
Carex rossii W. Boott (Ross sedge)
Carex tumulicola Mack. (foothill sedge)
JUNCACEAE (Rush Family)
Juncus bolanderi Engelm. (Bolander's rush)
Juncus balticus Willd. (Baltic rush)
Juncus effusus L. (soft rush)
Juncus patens E. Mey. (spreading rush)
Juncus tenuis Willd. (slender rush)
Luzula multiflora (Ehrh.) Lej. ssp. *multiflora* (common woodrush)
IRIDACEAE (Iris Family)
Iris bracteata S. Watson (Siskiyou iris)
Iris chrysophylla Howell (slender-tubed iris)
Sisyrinchium bellum S. Watson (California blue-eyed grass)
LILIACEAE (Lily Family)
Allium amplectens Torr. (slenderleaf onion)
Allium bolanderi S. Watson (Bolander's onion)
Allium falcifolium Hook. & Arn. (sickle leaved onion)
Allium sanbornii A.W. Wood (Sanborn's onion)
Calochortus tolmiei Hook. & Arn. (Oregon mariposa lily)
Calochortus uniflorus Hook. & Arn. (shortstem mariposa)
Camassia quamash (Pursh) Greene (common camas)
Chlorogalum pomeridianum (DC.) Kunth (soap plant)
Erythronium howellii S. Watson (Howell's fawnlily)
Fritillaria affinis (Schult.) Sealy (checker lily)
Fritillaria glauca (Pursh) Spreng. (Siskiyou fritillary)
Fritillaria pudica (Pursh) Spreng. (yellow bells)
Hastingsia alba (Durand) S. Watson (serpentine rush lily)
Maianthemum racemosum (L.) Link ssp. *amplexicaule* (Nutt.) LaFrankie (false Solomon's seal)
Triteleia howellii x *Triteleia multiflora* (hybrid triteleia)
Zigadenus venenosus S. Watson (meadow deathcamas)
ORCHIDACEAE (Orchid Family)
Calypso bulbosa (L.) Oakes (fairyslipper orchid)
Cypripedium montanum Douglas ex Lindl. (mountain lady slipper)
Goodyera oblongifolia Raf. (rattlesnake plantain)
Piperia candida Rand. Morgan & Ackerman (short-spurred reinorchid)
POACEAE (Grass Family)
Achnatherum lemmonii (Vasey) Barkworth (Lemmon's needlegrass)
Aira caryophyllea L. (silver hairgrass)
Aristida oligantha Michx. (oldfield threeawn)
Bromus hordeaceus L. (soft brome)
Bromus tectorum L. (cheatgrass)
Danthonia californica Bol. (California oatgrass)
Deschampsia cespitosa (L.) P. Beauv. (tufted hairgrass)
Elymus elymoides (Raf.) Swezey (bottlebrush squirreltail)
Elymus glaucus Buckley (blue wildrye)
Festuca roemeri Yu.E. Alexeev var. *klamathensis* (Klamath fescue)
Holcus lanatus L. (common velvetgrass)
Koeleria macrantha (Ledeb.) Schult. (prairie junegrass)
Melica geyeri Munro ex Bol. (Geyer's oniongrass)
Poa secunda J. Presl ssp. *juncifolia* (Scribn.) Soreng (Nevada bluegrass)
Poa secunda J. Presl ssp. *secunda* (Sandberg bluegrass)
Taeniatherum caput-medusae (L.) Nevski (medusahead wildrye)
Vulpia bromoides (L.) Gray (six-weeks fescue)

Mark R. Mousseaux (yes, it's French-Canadian… pronounced "Moo-So") is the Medford BLM District Botanist and is responsible for coordination of the Botany/Rare plant, and ACEC program for the Medford District. He and his nine-year-old daughter have lived in southwestern Oregon since 2000. He was the US Forest Service Forest Botanist for the Idaho Panhandle National Forests in Coeur d'Alene, Idaho, for 6 years prior to coming to the BLM. He received a Masters in Forest Science in 1992 from the University of Idaho.

Beatty Creek Research Natural Area

Susan Carter
Roseburg District BLM, 777 NW Garden Valley Blvd., Roseburg, OR 97470

Beatty Rocks as viewed from Cow Creek Road. Photo by Susan Carter.

Tucked away on the north slope of Cow Creek Canyon approximately 10 miles southwest of Myrtle Creek in Douglas County, Beatty Creek Research Natural Area (RNA) preserves a prime example of serpentine pine savanna at the north end of the Klamath Mountains Ecoregion (Allan and others 2001). Here, under the open canopy of scraggly Jeffrey pine (*Pinus jeffreyi*), several rare plants make their home: wayside aster (*Eucephalus vialis*), Bolander's onion (*Allium bolanderi* var. *mirabile*), Douglas monkey flower (*Mimulus douglasii*), and California sandwort (*Minuartia californica*). In addition, Beatty Creek RNA is a fungus lover's paradise, as revealed by recent inventories of its rich nonvascular and fungal community: 75 lichen species, 62 bryophyte species, and 198 mushroom and truffle species (Stone 1997, Wagner 1997, Trappe 1999). [These lists are available online at http://www.npsoregon.org/lists/plantlists/beatty_creek.htm] The rare moss, *Pseudoleskeella serpentinensis*, inhabits serpentine rock outcrops.

Beatty Creek is one of ten Areas of Critical Environmental Concern (ACEC) managed by the Bureau of Land Management (BLM) Roseburg District. It was first established as an RNA in 1983 to protect representative serpentine plant communities identified in the Oregon Natural Heritage Plan (Oregon Natural Heritage Advisory Council 1998). Beatty Creek was designated an ACEC/RNA in 1995 (BLM 1995). Although the RNA originally encompassed only 173 acres, the BLM Roseburg District Resource Management Plan provided for its expansion within the Beatty Creek watershed by purchase or land exchange (BLM 1995). Twenty acres were purchased from Silver Butte Timber Company in 2002 and approximately 657 acres were added in 2003 through direct exchange with Roseburg Resources Company. The BLM currently manages approximately 850 acres as the Beatty Creek ACEC/RNA. The RNA now encompasses the entire lower portion of the Beatty Creek watershed, a small perennial stream which drains into Cow Creek, a tributary of the South Umpqua River. In addition, the 280 acres lying adjacent to the new north boundary of the RNA have been withdrawn from active forest management by the BLM due to fragile soils.

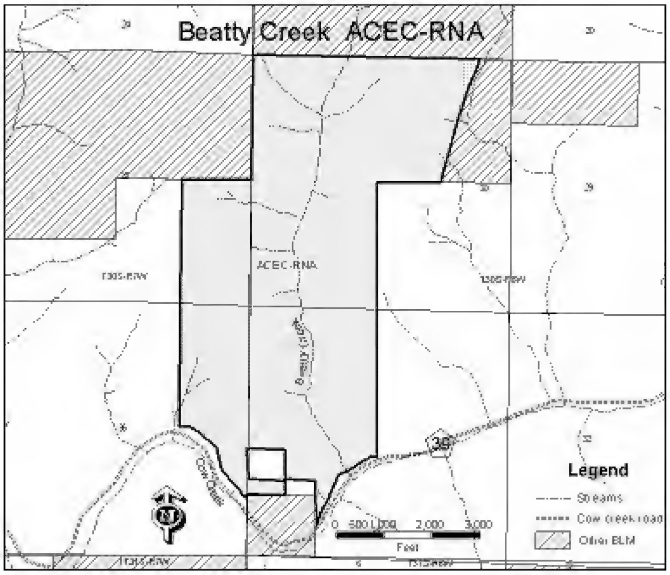
Grassland, chaparral, and forest associations are all represented, including the riparian forest along Beatty Creek. The riparian

Crinite mariposa lily (*Calochortus coxii*) is a rare serpentine endemic. Photo by Frank Callahan.

association includes Port Orford cedar (*Cupressus lawsoniana*) in the overstory and California laurel (*Umbellularia californica*) in the understory. Both of these species occur here at the eastern edge of their range in Oregon. Populations of seven special status species occur within the RNA and there is potential habitat for the serpentine endemic, crinite mariposa lily (*Calochortus coxii*), on the recently acquired addition to the RNA.

Climate

The climate is characterized by hot, dry summers and cool, wet winters. From late fall through spring, unstable low-pressure air masses carry frequent storms from the Pacific Ocean. During summer, stable high-pressure air masses bring clear skies and frequent temperature inversions. Precipitation averages about 40 inches per year, with 70% occurring from November to March. Average daily temperatures are 40°F in January and 65°F in July. Summer maximum temperatures reduce relative humidity to 40 to 45%, and occasionally to 15 to 20%. Evapo-transpiration at this time far exceeds the available soil moisture, leading to plant moisture stress, especially on south- and west-facing exposures.



Map of Beatty Creek ACEC/RNA.

Geology and Soils

Beatty Creek RNA lies within the northern portion of the Klamath Mountains Ecoregion, a region whose complex geology of folded, faulted, intruded, metamorphosed rock contains the highest concentration of serpentine bedrock in North America (Kruckeberg 1984). Serpentine rock is the metamorphosed remains of magnesium-rich igneous rock, commonly peridotite. A band of serpentine ranging from one to three miles wide crosses southern Douglas County near Cow Creek as it extends northeasterly to Little River (Ramp 1972). Most of the Beatty Creek RNA is underlain by this serpentine bedrock, except at the mouth of the creek, where marine siltstone, sandstone, and conglomerate bedrock forms exposed rock outcrops visible from the Cow Creek Road. The flora and soils of the marine conglomerate differ from the flora and soils of the serpentine intrusives in the rest of the RNA. The two main soil types derive from the two types of parent bedrock. Dubakella-Pearsoll soil associations derive from the weathering of serpentine and peridotite ultramafic bedrock. These shallow (20 to 40 inches), reddish-brown, gravelly, rocky soils are xeric, and generally occur on steep or very steep slopes. The Josephine-Speaker soil complex derives from the marine conglomerate. These soils are brown, well-drained, very gravelly loams. The Josephine-Speaker soil association supports mesic forest and oak-madrone forest (NRCS 1995).

Human Use

With the exception of a spur road which the BLM blocked off and a few old mining prospect pits, there is little evidence of past disturbance in the original RNA. However, approximately 80 acres of the new acquisition area was logged by the previous land owner. A network of skid trails is still apparent. Just north of the Central Oregon and Pacific railroad right-of-way, which was constructed in 1882, parts of a livestock fence remain, indicating that grazing may have occurred there at one time.

Although there is no direct evidence of Native American use in the RNA, early inhabitants may have burned the area to reduce brush to aid in the hunting of game animals and to ready tarweed plants for harvest (Riddle 1953).

Plant Communities/Ecology

Jeffrey pine savanna covers most of the RNA, with a small amount of late-successional Douglas fir forest, oak-madrone woodland, and rock outcrops (marine conglomerate) near the southern boundary. Jeffrey pine savanna occurs primarily on upland soils derived from serpentine parent material. In addition to Jeffrey pine, you will encounter incense cedar (*Calocedrus decurrens*), Pacific madrone

Jeffrey pine savanna. Photo by Russ Holmes.

(*Arbutus menziesii*), Douglas fir (*Pseudotsuga menziesii*), and shrub-form California laurel. The shrub component, typically buckbrush (*Ceanothus cuneatus*), poison oak (*Toxicodendron diversilobum*), and oceanspray (*Holodiscus discolor*), is widely scattered. However, buckbrush sometimes forms dense patches in the larger savanna openings. Ground cover is dominated by a wide variety of herbaceous species. Visit the RNA in the spring to enjoy a wildflower display that includes grass widows (*Olsynium douglasii* var. *douglasii)*, Henderson's shooting star (*Dodecatheon hendersonii*), common woolly sunflower (*Eriophyllum lanatum*), western buttercup (*Ranunculus occidentalis*), pennycress (*Thlaspi montanum* var. *montanum*), spring gold (*Crocidium multicaule*), Menzies's larkspur (*Delphinium menziesii*), yellowleaf iris (*Iris chrysophylla*), Henderson's triteleia (*Triteleia hendersonii* var. *hendersonii*), and showy tarweed (*Madia elegans*). In this serpentine-influenced community, exotic species are a minor component, consisting of an occasional St. John's wort (*Hypericum perforatum*), or one of the non-native annual grasses ubiquitous to southwestern Oregon: hedgehog dogtail (*Cynosurus echinatus*), or one of several annual bromes (*Bromus mollis, B. rigidus, B. sterilis*, or *B. tectorum*).

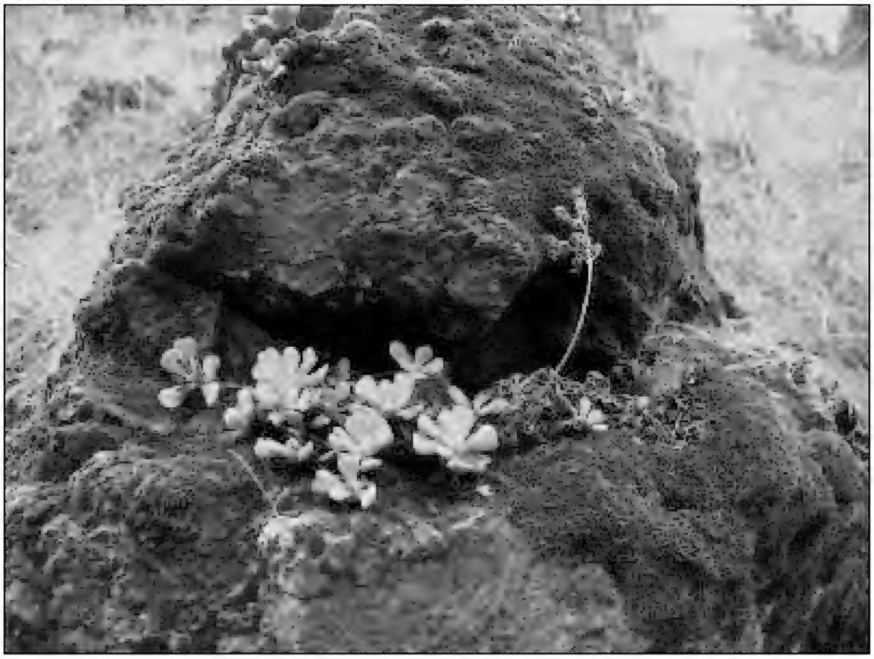
The riparian community flanks Beatty Creek as a narrow band of mixed evergreen forest (Zika 1987). Tree species include Douglas fir, incense cedar, Port Orford cedar, Oregon ash (*Fraxinus latifolia*), big leaf maple (*Acer macrophyllum*), Pacific yew (*Taxus brevifolia*), California laurel, and alder (*Alnus rubra*). Shrubs include western azalea (*Rhododendron occidentale*), ocean spray, and poison oak. Port Orford root rot (*Phytophthora lateralis*) has not been observed anywhere in the drainage.

Serpentine-influenced soils cease at the lower extremes of the watershed and the community grades into a Douglas fir forest. In addition to Douglas fir, there is Pacific madrone, Jeffrey pine, canyon live oak (*Quercus chrysolepis*), and California laurel. The lower southwest portion of the watershed supports an oak-madrone woodland, dominated by canyon live oak and pacific madrone. Poison oak, hoary manzanita (*Arctostaphylos canescens*), and bristly manzanita (*Arctostaphylos columbiana*) are the most common shrubs. Non-forested outcrops of marine conglomerates also occur in the lower watershed and are dominated by herbaceous and shrubby species. Many exotic species and noxious weeds have invaded the lower part of the drainage near the Cow Creek Road, especially on the non-serpentine soils. These include meadow knapweed (*Centaurea* x*pratensis*), yellow starthistle (*Centaurea solstitialis*), rush skeletonweed (*Chondrilla juncea*), Scots broom (*Cytisus scoparius*), and Himalayan blackberry (*Rubus armeniacus*). Yellow starthistle and rush skeletonweed infestations are small, having been introduced relatively recently. BLM is working to control these weeds before they spread.

Serpentine Endemics

Soils derived from serpentine rock have chemical and physical properties that make plant growth difficult. Low in nitrogen, phosphorus, and relatively low in calcium, these soils contain relatively high levels of magnesium and iron, as well as heavy metals such as chromium and nickel, in concentrations high enough to be toxic to some plants. Nickel and chromite have been extracted

Buckbrush (*Ceanothus cuneatus*) is the most common shrub in serpentine Jeffrey pine savannas. Photo by Russ Holmes.



The rare moss, *Pseudoleskeella serpentinensis*, surrounds spatula leaf stonecrop (*Sedum spathulifolium*) on a serpentine rock outcrop. Photo by Susan Carter.

at the Hanna Nickel Mine, approximately two and a half miles northeast of Beatty Creek RNA. Compounding the unfavorable mineral composition, these soils are highly erodible, and have low moisture availability, resulting in a harsh environment for plants. As a result, serpentine habitats have led to a specialized native flora, a high level of endemism, and a relative lack of invasion by non-native plants.

Although Jeffery pine is common on non-serpentine soils in the Sierra Nevada Mountains, in the Klamath Mountains it is largely restricted to serpentine sites (Coleman and Kruckeberg 1999). Serpentine endemics of the Beatty Creek RNA include scorpion weed (*Phacelia capitata*), lax stonecrop (*Sedum laxum* ssp. *laxum*), common eriophyllum (*Eriophyllum lanatum*), and small flowered willow herb (*Epilobium minutum)* (Coleman and Kruckeberg 1999, White 1971, as cited in Franklin and Dyrness 1988). Other species that are good indicators of serpentine, but may also occur on non-serpentine include podfern (*Aspidotis densa*), Port Orford cedar, California laurel, bigseed biscuitroot (*Lomatium macrocarpum*), buckbrush, and canyon live oak (Coleman and Kruckeberg 1999, Whittaker 1960 as cited in Franklin and Dyrness 1988).

Special Status Plant Species

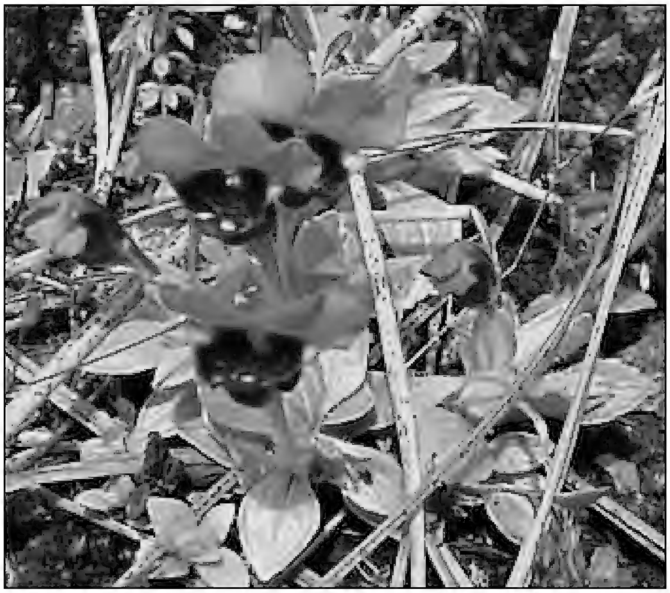
Special status plant species include wayside aster, the moss *Pseudoleskeella serpentinensis*, Bolander's onion, Douglas monkey flower, and California sandwort. Wayside aster, a State Threatened and BLM Sensitive species (Oregon Natural Heritage Plan (ONHP) List 1), grows along Beatty Creek and some of its seasonal tributaries in the transition zone between the riparian forest and the upland grassland. The population is somewhat continuous throughout the drainage and forms one of the larger populations in the species' range. Most of the population (over 60%) grows in the recently acquired parcels in the watershed. Wayside aster is a tall perennial with one to several stems. The simple, dull green leaves clasp the stem, and the rayless flower heads are grouped at the end of the stems. There are no other aster species in the area.

Six populations of *Pseudoleskeella serpentinensis*, a BLM Assessment species (ONHP List 2), are known to occur on the serpentine rock outcrops. *Pseudoleskeella serpentinensis* forms reddish mats on the rocks. Its tiny leaves grow on filamentous stems.

Bolander's onion is found scattered in openings on east-facing serpentine slopes. Bolander's onion has 10-20 red-purple flowers in a head at the top of the long peduncle. The other onion known from the area, narrowleaf onion, has about 10-50 white to pink spreading flowers in the inflorescence.

Douglas monkey flower is found in serpentine openings of the shrub and Jeffrey pine associations as well as among mosses and short annuals on the conglomerate ledges at the mouth of Beatty Creek. Douglas monkey flower is a small compact annual with dark pink or maroon flowers. The upper petals look like mouse ears and the lower petals barely protrude from the lower lip. Other monkey flowers in the area are found in wetter habitats and have yellow flowers.

California sandwort grows on nearly bare soils on open slopes or ridges in the Jeffrey pine and shrub associations. California sandwort is a small plant with five-petaled flowers. It can be distinguished from the more common Douglas sandwort (*Minuartia douglasii*) by its smaller leaves. California sandwort has small, somewhat oblong leaves while Douglas sandwort has long, thread-like leaves that become curly. Bolander's onion, Douglas monkey flower, and California sandwort are BLM Tracking species (ONHP List 4).



Douglas monkeyflower (*Mimulus douglasii*). Photo by Gary Basham.

The recently acquired lands support populations of spring phacelia (*Phacelia verna*) (BLM Tracking and ONHP List 4), and

California sword fern (*Polysticum californicum*) (BLM Assessment and ONHP List 2). Both spring phacelia and California sword fern occur on the marine conglomerate outcrops. Spring phacelia is restricted to shallow moss cover over bedrock where there is very little grass and forb cover. Spring phacelia is a small annual with ovate leaves and flowers coiled in a fiddle neck. The common scorpion weed (*P. capitata*) is a perennial with long, narrow leaves and flowers densely clustered in a head. California sword fern occurs on rock bluffs with virtually no associated vegetation.

Serpentine areas in the acquired parcel are potential habitat for crinite mariposa lily, an endemic species restricted to serpentine sites in Douglas County (State Endangered and Bureau Sensitive species (ONHP List 1). Although not yet found at Beatty Creek, it has been identified in the Lower Cow Creek watershed, less than five miles from the acquisition parcel in areas of similar soils and plant associations.

Spring phacelia (*Phacelia verna*) grows among the moss on marine conglomerate outcrops, with a sparse cover of grasses and forbs. Photo by Russ Holmes.

Range Extension

The Port Orford cedar that forms a common component of the riparian habitat along Beatty Creek is noteworthy because it is free of the introduced root disease fungus *Phytophthora lateralis* (Casavan, pers. comm.). This population along the eastern edge of the species' range in Oregon occurs in relatively dry serpentine habitat, which differs significantly from typical habits closer to the center of the species' range. The Beatty Creek population may contain highly desirable genotypes resistant to the root disease.

Visiting Beatty Creek RNA

Take exit 103 from Interstate 5, and drive west on Highway 39 toward Riddle, Oregon. After following the Cow Creek Road (Highway 39) for about 8 miles, there is an unmarked pullout along the road with parking for about two vehicles. The RNA lies just north of Cow Creek Road. Visitors can either walk up Beatty Creek (beware of poison oak) or scramble around and over the rock outcrops visible from Cow Creek Road. No other public roads or trails access the area.

Acknowledgments

K. Casavan provided information on Port Orford cedar and *Phytophthora lateralis*. The vascular plant list was developed by BLM staff and P. Zika. D. Stone inventoried the lichens; D. Wagner, the bryophytes; and J. Trappe, the mushrooms and truffles. The bryophyte and fungi lists were reviewed by Dave Wagner and Dan Luoma.

References

Allan S, Buckley AR, Meacham, JE. 2001. Atlas of Oregon, 2nd ed. Eugene (OR): University of Oregon Press. 301 p.

Coleman RG, Kruckeberg AR. 1999. Geology and plant life of the Klamath-Siskiyou mountain region. Natural Areas Journal 19:320-340.

Franklin JF, Dyrness CT. 1988. Natural Vegetation of Oregon and Washington. Corvallis (OR): USDA Forest Service Gen Tech Rep PNW-8 (1973), Oregon State University Press.

Kruckeberg AR. 1984. California Serpentines: Flora, Vegetation, Geology, Soils, and Management Problems. Univ Calif Pub Bot 78. Berkeley (CA): University of California Press. 108 p.

Oregon Natural Heritage Advisory Council. 1998. Oregon Natural Heritage Plan. Salem (OR): State Land Board.

Ramp L. 1972. Geology and Mineral Resources of Douglas County, Oregon. Oregon Dep Geol Mineral Indust Bull 75:1-106.

Riddle GW. 1953. History of Early Days in Oregon, a History of the Riddle Valley. Myrtle Creek (OR): Myrtle Creek Mail.

Stone D. 1997. Inventory of Lichen Species at Beatty Creek ACEC. Unpublished list on file at BLM Roseburg District office.

Trappe JM. 1999. Beatty Creek Research Natural Area Mushroom and Truffle Survey, 1997. Unpublished report on file at BLM Roseburg District office.

[USDA NRCS] Natural Resources Conservation Service. 1995. Soil survey of Douglas County Area, Oregon. Unpublished report.

[USDI BLM] Bureau of Land Management. 1995. Roseburg District Record of Decision and Resource Management Plan. Report on file at BLM Roseburg District office.

Wagner DH. 1997. Inventory of Bryophytes of Roseburg District, Bureau of Land Management, Douglas County, Oregon. Unpublished report on file at BLM Roseburg District office.

Zika PF. 1987. The Vascular Flora of Beatty Creek Research Natural Area. Unpublished report on file at BLM Roseburg District office.

Vascular Plant Species List

Nomenclature follows the Oregon Flora Project checklist. Names of taxa native to Oregon are printed in italic *Garamond*; alien taxa are in italic ***Gill Sans***, a sans-serif type.

FERNS AND THEIR ALLIES

DENNSTAEDTIACEAE (Bracken Family)

Pteridium aquilinum (L.) Kuhn (western brackenfern)

DRYOPTERIDACEAE (Wood Fern Family)

Cystopteris fragilis (L.) Bernh. (brittle bladder fern)

Dryopteris arguta (Kaulf.) Maxon (coastal shield fern)

Polystichum imbricans (D.C. Eaton) D.H. Wagner ssp. *imbricans* (narrowleaf swordfern)

Polystichum munitum (Kaulfuss) K. Presl (western swordfern)
EQUISETACEAE (Horsetail Family)
Equisetum hyemale L. (common scouring rush)
Equisetum telmateia Ehrh. (giant horsetail)
POLYPODIACEAE (Polypody Family)
Polypodium glycyrrhiza D.C. Eaton (licorice fern)
Polypodium hesperium Maxon (western polypody)
PTERIDACEAE (Brake Family)
Adiantum aleuticum (Rupr.) C.A. Paris (maidenhair fern)
Aspidotis densa (Brack.) Lellinger (podfern, Indian dream)
Pentagramma triangularis (Kaulf.) Yatsk., Windham, E. Wollenw. (gold-black fern)
SELAGINELLACEAE
Selaginella wallacei Hieron. (Wallace's selaginella)

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)
Calocedrus decurrens (Torr.) Florin (incense cedar)
Chamaecyparis lawsoniana (A. Murr.) Parl. (Port Orford cedar)
PINACEAE (Pine Family)
Pinus jeffreyi Balf. (Jeffrey pine)
Pinus lambertiana Douglas (sugar pine)
Pseudotsuga menziesii (Mirb.) Franco var. *menziesii* (Douglas fir)
TAXACEAE (Yew Family)
Taxus brevifolia Nutt. (Pacific yew)

DICOTYLEDONS

ACERACEAE (Maple Family)
Acer macrophyllum Pursh (big-leaf maple)
ANACARDIACEAE (Sumac Family)
Toxicodendron diversilobum (Torr. & A. Gray) Greene (poison oak)
APIACEAE (Carrot Family)
Angelica arguta Nutt. (shining angelica)
Daucus carota L. (Queen Anne's lace)
Daucus pusillus Michx. (American wild carrot)
Lomatium macrocarpum (Nutt.) J.M. Coult. & Rose (bigseed biscuitroot)
Lomatium nudicaule (Pursh) J.M. Coult. & Rose (barestem biscuitroot)
Lomatium utriculatum (Nutt.) J.M. Coult. & Rose (Pomo celery or common lomatium)
Osmorhiza berteroi DC. (mountain sweet cicely)
Perideridia sp. (yampah)
Sanicula bipinnatifida Douglas ex Hook. (purple sanicle)
Sanicula crassicaulis Poepp. (Pacific blacksnakeroot)
Sanicula graveolens Poepp. (northern sanicle)
Torilis arvensis (Huds.) Link (spreading hedge parsley)
Yabea microcarpa (Hook. & Arn.) Koso-Pol. (false carrot)
APOCYNACEAE (Dogbane Family)
Apocynum sp. (dogbane)
ASCLEPIADACEAE (Milkweed Family)
Asclepias cordifolia (Benth.) Jeps. (purple milkweed)
ASTERACEAE (Sunflower Family)
Achillea millefolium L. (common yarrow)
Agoseris grandiflora (Nutt.) Greene (large flowered agoseris)
Agoseris heterophylla (Nutt.) Greene (annual agoseris)
Anisocarpus madioides Nutt. (woodland tarweed)
Cacaliopsis nardosmia (A. Gray) A. Gray (silvercrown)
Centaurea xpratensis Thuill. (meadow knapweed)
Centaurea melitensis L. (tocalote, Maltese starthistle)
Centaurea solstitialis L. (yellow starthistle)
Cirsium remotifolium (Hook.) DC. (few-leaved thistle)
Cirsium vulgare (Savi) Ten. (bull thistle)
Crocidium multicaule Hook. (spring gold)
Ericameria nauseosa (Pall. ex Pursh) G.L. Nesom & G.I. Baird (rubber rabbit brush)
Eriophyllum lanatum (Pursh) J. Forbes (common eriophyllum)
Gnaphalium purpureum L. (purple cudweed)
Hieracium albiflorum Hook. (white flowered hawkweed)
Hieracium scouleri Hook. (houndstongue hawkweed)
Hypochaeris glabra L. (smooth cat's ear)
Hypocharis radicata L. (spotted or hairy cat's ear)
Lasthenia californica DC. ex Lindl. (slender gold fields)
Leucanthemum vulgare Lam. (oxeye daisy)
Madia elegans D. Don ex Lindl. (showy tarweed)
Madia exigua (Sm.) A. Gray (little tarweed)
Madia gracilis (Sm.) D.D. Keck (slender or common tarweed)
Matricaria discoidea DC. (pineapple weed)
Micropus californicus Fisch. & C.A. Mey. (slender cottonweed)
Rigiopappus leptocladus A. Gray (bristle head)
Senecio integerrimus Nutt. (western groundsel)
Senecio vulgaris L. (old man in the spring)
Sonchus asper (L.) Hill (prickly sow thistle)
Taraxacum officinale Weber ex F.H. Wigg. (common dandelion)
Tragopogon dubius Scop. (yellow salsify)
Uropappus lindleyi (DC.) Nutt. (silver puffs)
Wyethia angustifolia (DC.) Nutt. (narrow leaf wyethia)
BERBERIDACEAE
Achlys triphylla (Sm.) DC. (vanilla leaf)
Berberis aquifolium Pursh (hollyleaved barberry)
Vancouveria hexandra (Hook.) C. Morren & Decne. (white inside-out flower)
BETULACEAE (Birch Family)
Alnus rubra Bong. (red or Oregon alder)
Corylus cornuta Marshall (hazelnut)
BORAGINACEAE (Borage Family)
Cryptantha intermedia (A. Gray) Greene (common cryptantha)
Myosotis discolor Pers. (yellow and blue forget-me-not)
Plagiobothrys nothofulvus A. Gray (rusty popcorn flower)
Plagiobthrys tenellus (Nutt.) A. Gray (slender popcorn flower)
BRASSICACEAE (Mustard Family)
Arabis subpinnatifida Rollins (Klamath rockcress)
Athysanus pusillus (Hook.) Greene (sandweed)
Cardamine nuttallii Greene var. *nuttallii* (palmate toothwort)
Cardamine oligosperma Nutt. (littlewestern bittercress)
Draba verna L. (spring whitlow-grass)
Erysimum capitatum (Douglas ex Hook.) Greene (Douglas wallflower)
Lepidium nitidum Nutt. (shining peppergrass)
Thlaspi montanum L. (wild candytuft, pennycress)
Thysanocarpus curvipes Hook. (lacepod, fringepod)
CAMPANULACEAE (Bellflower Family)
Githopsis specularioides Nutt. (common blue cup)
CAPRIFOLIACEAE (Honeysuckle Family)
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray (hairy honeysuckle)

Symphoricarpos albus (L.) S.F. Blake var. *laevigatus* Fernald (common snowberry)
Symphoricarpos mollis Nutt. (creeping snowberry)
CARYOPHYLLACEAE (Pink Family)
Cerastium arvense L. (field chickweed)
Cerastium glomeratum Thuill. (sticky chickweed)
Minuartia californica (A. Gray) Mattf. (California sandwort)
Minuartia douglasii (Fenzl ex Torr. & A. Gray) Mattf. (Douglas sandwort)
Sagina decumbens (Elliott) Torr. & A. Gray (western pearlwort)
Silene gallica L. (windmill pink)
Silene hookeri Nutt. (Hooker's silene)
Spergularia rubra (L.) J. Presl & C. Presl (red sandspurry)
Stellaria media (L.) Vill. (chickweed)
Stellaria nitens Nutt. (shining chickweed)
CONVOLVULACEAE (Morning-glory Family)
Calystegia occidentalis (A. Gray) Brummitt ssp. *occidentalis* (chaparral false bindweed)
CRASSULACEAE (Stonecrop Family)
Crassula connata (Ruíz & Pav.) A. Berger (erect pigmy weed)
Sedum laxum (Britton) A. Berger (lax stonecrop)
Sedum spathulifolium Hook. (spatula leaf stonecrop)
Sedum stenopetalum Pursh (wormleaf stonecrop)
DISPACACEAE (Teasel Family)
Dipsacus fullonum L. (fuller's teasel)
ERICACEAE (Heath Family)
Arbutus menziesii Pursh (Pacific madrone)
Arctostaphylos canescens Eastw. (hoary manzanita)
Arctostaphylos columbiana Piper (bristly manzanita)
Rhododendron occidentale (Torr. & A. Gray) A. Gray (western azalea)
Vaccinium ovatum Pursh (evergreen huckleberry)
EUPHORBIACEAE (Spurge Family)
Euphorbia crenulata Engelm. (beetle or western wood spurge)
Euphorbia spathulata Lam. (spatulate leaved spurge)
FABACEAE (Legume Family)
Cytisus scoparius (L.) Link (Scots broom)
Lathyrus nevadensis S. Watson (Nuttall's peavine)
Lathyrus polyphyllus Nutt. (leafy peavine)
Lotus micranthus Benth. (small-flowered deervetch)
Lupinus bicolor Lindl. (miniature lupine)
Lupinus albifrons Benth. (silver lupine)
Rupertia physodes (Hook.) J.W. Grimes (forest scurf pea)
Trifolium bifidum A. Gray (notchleaf clover)
Trifolium albopurpureum Torr. & A. Gray var. *dichotomum* (Hook. & Arn.) Isely (branched Indian clover)
Trifolium dubium Sibth. (suckling or least hop clover)
Trifolium microcephalum Pursh (woolly or small headed clover)
Trifolium microdon Hook. & Arn. (thimble clover)
Trifolium variegatum Nutt. (white tip clover)
Trifolium willdenovii Spreng. (tomcat clover)
Vicia americana Muhl. ex Willd. ssp. *americana* (American vetch)
Vicia sativa L. (garden vetch)
FAGACEAE (Oak Family)
Quercus chrysolepis Liebm. (canyon live oak)
Quercus garryana Douglas ex Hook. (Oregon white oak)
Quercus kelloggii Newb. (California black oak)
GENTIANACEAE (Gentian Family)
Centaurium erythraea Rafn (European centaury)
GERANIACEAE (Geranium Family)
Erodium cicutarium (L.) L'Hér. ex Aiton (redstem filaree)
GROSSULARIACEAE (Gooseberry Family)
Ribes roezlii Regel var. *cruentum* (Greene) Rehder (shinyleaf gooseberry)
Ribes sanguineum Pursh (redflowered currant)
HYDRANGEACEAE (Hydrangea Family)
Philadelphus lewisii Pursh (mockorange)
Whipplea modesta Torr. (yerba de selva)
HYDROPHYLLACEAE (Waterleaf Family)
Nemophila menziesii Hook. & Arn. (baby blue-eyes)
Nemophila parviflora Douglas ex Benth. (small flowered nemophila)
Nemophila pedunculata Douglas ex Benth. (littlefoot nemophila)
Phacelia capitata Kruckeb. (scorpion weed)
HYPERICACEAE (St. John's Wort Family)
Hypericum perforatum L. (St. John's wort)
LAMIACEAE (Mint Family)
Monardella odoratissima Benth. (monardella)
Prunella vulgaris L. (self-heal)
Satureja douglasii (Benth.) Briq. (yerba buena)
Scutellaria antirrhinoides Benth. (snapdragon skullcap)
Stachys rigida Nutt. ex Benth. (rough hedgenettle)
LAURACEAE (Laurel Family)
Umbellularia californica (Hook. & Arn.) Nutt. (California laurel)
LINACEAE (Flax Family)
Hesperolinon micranthum (A. Gray) Small (smallflower dwarf-flax)
Linum bienne Mill. (pale or narrow leaved flax)
OLEACEAE (Ash Family)
Fraxinus latifolia Benth. (Oregon ash)
ONAGRACEAE (Evening Primrose Family)
Clarkia gracilis (Piper) A. Nelson & J.F. Macbr. (slender clarkia)
Epilobium minutum Lindl. (small flowered willow herb)
OROBANCHACEAE (Broomrape Family)
Orobanche uniflora L. (one-flowered broomrape)
PAPAVERACEAE (Poppy Family)
Eschscholzia californica Cham. (California poppy)
PLANTAGINACEAE (Plantain Family)
Plantago lanceolata L. (English plantain)
POLEMONIACEAE (Phlox Family)
Collomia grandiflora Douglas ex Lindl. (large-flowered collomia)
Collomia heterophylla Hook. (varied leaf collomia)
Gilia capitata Sims (bluefield or globe gilia)
Linanthus bicolor (Nutt.) Greene (bicolored linanthus)
Linanthus bolanderi (A. Gray) Greene (Bolander's linanthus)
Navarretia intertexta (Benth.) Hook. (needle-leaf navarettia)
Phlox gracilis (Hook.) Greene (slender phlox)
POLYGONACEAE (Buckwheat Family)
Eriogonum nudum Douglas ex Benth. (barestem buckwheat)
Polygonum sp. (knotweed)
Rumex acetosella L. (sheep sorrel)
Rumex sp. (dock)
PORTULACACEAE (Purslane Family)
Claytonia perfoliata Donn ex Willd. (miner's lettuce)
Claytonia sibirica L. (candyflower)
Montia fontana L. (water chickweed)

PRIMULACEAE (Primrose Family)
Dodecatheon hendersonii A. Gray (Henderson's shooting star)
Trientalis latifolia Hook. (broadleaf starflower)
RANUNCULACEAE (Buttercup Family)
Aquilegia formosa Fisch. ex DC (red columbine)
Delphinium menziesii DC. (Menzies' larkspur)
Ranunculus occidentalis Nutt. (western buttercup)
Ranunculus uncinatus D. Don (little buttercup)
RHAMNACEAE (Buckthorn Family)
Ceanothus cuneatus (Hook.) Nutt. ex Torr. & A. Gray (buckbrush)
Rhamnus purshiana DC. (cascara)
ROSACEAE (Rose Family)
Amelanchier alnifolia (Nutt.) Nutt. ex M. Roem. (western serviceberry)
Aphanes occidentalis (Nutt.) Rydb. (western lady's mantle)
Crataegus monogyna Jacq. (English hawthorne)
Fragaria vesca L. (wood strawberry)
Holodiscus discolor (Pursh) Maxim. (creambush oceanspray)
Oemleria cerasiformis (Torr. & A. Gray ex Hook. & Arn.) J.W. Landon (osoberry)
Rosa eglanteria L. (sweetbriar)
Rosa gymnocarpa Nutt. (baldhip rose)
Rubus armeniacus Focke (Himalayan blackberry)
Rubus leucodermis Douglas ex Torr. & A. Gray (black raspberry)
Rubus parviflorus Nutt. (thimbleberry)
Rubus spectabilis Pursh (salmonberry)
Rubus ursinus Cham. & Schltdl. (Pacific dewberry)
RUBIACEAE (Madder Family)
Galium aparine L. (stickywilly)
Galium parisiense L. (wall bedstraw)
Galium triflorum Michx. (sweetscented bedstraw)
Sherardia arvensis L. (blue field madder)
SAXIFRAGACEAE (Saxifrage Family)
Heuchera micrantha Douglas ex Lindl. (small flowered alumroot)
Lithophragma parviflorum (Hook.) Nutt. ex Torr. & A. Gray (small flowered woodland star)
Saxifraga integrifolia Hook. (swamp saxifrage)
SCROPHULARIACEAE (Figwort Family)
Castilleja attenuata (A. Gray) T.I. Chuang & Heckard (attenuate Indian paintbrush)
Castilleja pruinosa Fernald (frosted paintbrush)
Castilleja tenuis A. Gray (hairy owl clover)
Collinsia grandiflora Douglas ex Lindl. (large flowered blue eyed Mary)
Collinsia parviflora Douglas ex Lindl. (small flowered blue eyed Mary)
Collinsia rattanii A. Gray (Rattan collinsia)
Digitalis purpurea L. (foxglove)
Mimulus alsinoides Douglas ex Benth. (chickweed mimulus)
Mimulus douglasii (Benth.) A. Gray (Douglas monkey flower)
Mimulus guttatus DC. (yellow monkey flower)
Penstemon laetus A. Gray (gay penstemon)
Synthyris reniformis (Douglas ex Benth.) Benth. (snow-queen)
Tonella tenella (Benth.) A. Heller (lesser baby innocence)
Triphysaria pusilla (Benth.) T.I. Chuang & Heckard (dwarf owl clover)
Veronica arvensis L. (wall or common speedwell)
VALERIANACEAE (Valerian Family)
Plectritis congesta (Lindl.) DC. (shortspur seablush)
Valerianella locusta (L.) Laterr. (European corn salad)
VIOLACEAE (Violet Family)
Viola glabella Nutt. ex Torr. & A. Gray (stream or pioneer violet)
Viola hallii A. Gray (Oregon violet)
Viola lobata Benth. ssp. *integrifolia* (S. Watson) R.J. Little (pine violet)
VISCACEAE (Mistletoe Family)
Arceuthobium campylopodum Engelm. (western dwarf mistletoe)

MONOCOTYLEDONS

CYPERACEAE (Sedge Family)
Carex deweyana Schwein. (Dewey's sedge)
Carex mendocinensis Olney (Mendocino sedge)
Carex tumulicola Mack. (splitawn sedge)
IRIDACEAE (Iris Family)
Iris chrysophylla Howell (yellowleaf iris)
Iris tenax Douglas ex Lindl. (toughleaf iris)
Olsynium douglasii (A. Dietr.) E.P. Bicknell var. *douglasii* (grass widows)
Sisyrinchium bellum S. Watson (narrowleaf blue-eyed grass)
JUNCACEAE (Rush Family)
Juncus bufonius L. (toad rush)
Juncus effusus L. (soft or common rush)
Luzula multiflora ssp. *multiflora* (field woodrush)
LILIACEAE (Lily Family)
Allium amplectens Torr. (narrowleaf onion)
Allium bolanderi S. Watson (Bolander's onion)
Brodiaea elegans Hoover (elegant brodiaea)
Calochortus tolmiei Hook. & Arn. (Tolmie's mariposa lily)
Camassia leichtlinii (Baker) S. Watson var. *suksdorfii* (Greenm.) C.L. Hitchc. (Suksdorf's camas)
Dichelostemma capitatum (Benth.) A.W. Wood (bluedicks)
Dichelostemma congestum (Sm.) Kunth (ookow)
Erythronium oregonum Applegate (giant fawn lily)
Fritillaria affinis (Schult.) Sealy var. *affinis* (checker lily)
Lilium pardalinum Kellogg (leopard or panther lily)
Maianthemum racemosum (L.) Link ssp. *amplexicaule* (Nutt.) LaFrankie (feathery false lily of the valley)
Maianthemum stellatum (L.) Link (starry false lily of the valley)
Prosartes hookeri Torr. (drops of gold)
Prosartes smithii (Hook.) Utech, Shinwari & Kawano (largeflower fairybells)
Trillium albidum J.D. Freeman (giant trillium or wake robin)
Trillium ovatum Pursh (white trillium)
Triteleia hendersonii Greene var. *hendersonii* (Henderson's triteleia)
Triteleia hyacinthina (Lindl.) Greene (hyacinth brodiaea)
Zigadenus venenosus S. Watson (death camas)
ORCHIDACEAE (Orchid Family)
Calypso bulbosa (L.) Oakes (fairy slipper)
Goodyera oblongifolia Raf. (western rattlesnake plantain)
Piperia unalascensis (Spreng.) Rydb. (slender-spire orchid)
POACEAE (Grass Family)
Achnatherum lemmonii (Vasey) Barkworth (Lemmon's needlegrass)
Agrostis exarata Trin. (spike bentgrass)
Aira caryophyllea L. (European silver hairgrass)
Arrhenatherum elatius (L.) P. Beauv. ex J. Presl & C. Presl (tall oatgrass)
Briza minor L. (little quaking grass)
Bromus carinatus Hook. & Arn. (California brome)
Bromus hordeaceus L. ssp. ***hordeaceus*** (soft brome)
Bromus rigidus Roth (ripgut)

Bromus rubens L. (red brome)
Bromus sterilis L. (barren brome)
Bromus tectorum L. (cheat grass)
Bromus vulgaris (Hook.) Shear (Columbia brome)
Cynosurus echinatus L. (hedgehog dogtail)
Danthonia californica Bol. (California oatgrass)
Deschampsia danthonioides (Trin.) Munro (annual hairgrass)
Deschampsia elongata (Hook.) Munro (slender hairgrass)
Elymus glaucus Buckley (blue wildrye)
Elymus multisetus (J.G. Sm.) M.E. Jones (big squirreltail)
Festuca californica Vasey (California fescue)
Festuca idahoensis Elmer (Idaho fescue)
Festuca occidentalis Hook. (western fescue)
Festuca rubra L. (red fescue)
Festuca subuliflora Scribn. (coast range fescue)
Gastridium phleoides (Nees & Meyen) C.E. Hubb. (nitgrass)
Hordeum brachyantherum Nevski (meadow barley)
Koeleria macrantha (Ledeb.) Schult. (prairie junegrass)
Lolium multiflorum Lam. (Italian ryegrass)
Lolium perenne L. (perennial ryegrass)
Melica geyeri Munro ex Bol. (Geyer's onion grass)
Melica harfordii Bol. (Harford's melic)
Melica subulata (Griseb.) Scribn. (Alaska oniongrass)
Poa annua L. (annual bluegrass)
Poa pratensis L. ssp. **pratensis** (Kentucky bluegrass)
Poa secunda J. Presl (pine bluegrass)
Schedonorus phoenix (Scop.) Holub (tall fescue)
Taeniatherum asperum (L.) Nevski (medusahead wildrye)
Trisetum canescens Buckley (tall trisetum)
Vulpia microstachys (Nutt.) Munro ex Benth. (small fescue)

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Horse Rock Ridge

Douglas Goldenberg
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Fine-grained basaltic dikes resistant to weathering protrude from the surrounding terrain in Horse Rock Ridge RNA. Photo by Cheshire Mayrsohn.

The grassy balds of Horse Rock Ridge Research Natural Area (RNA) are found on ridges and south-facing slopes within the Douglas fir forest of the Coburg Hills. These natural grasslands in the foothills of the Cascades bordering the southern Willamette Valley have fascinated naturalists with their contrast to the surrounding forests. The RNA was established to protect these meadows which owe their existence to thin soils associated with rock outcroppings. Surrounding old growth forest adds to the value of the Natural Area.

The Bureau of Land Management (BLM) recognized the site's botanical, wildlife, and scenic values by establishing it as an RNA/ACEC in June 1995 (Eugene District Resource Management Plan 1995). It had previously been established as an Area of Critical Environmental Concern (ACEC) in 1984. Contrasting habitats of moist forests, dry meadows, and rock outcrops enhance species diversity. Many of the meadow species are more common in eastern Oregon. The meadows at the site represent three native communities defined by their dominant grass species: blue wildrye (*Elymus glaucus*), Oregon fescue (*Festuca roemeri*), and Lemmon's needlegrass (*Achnatherum lemmonii*)/hairy racomitrium moss *(Racomitrium canescens)* (Curtis 2003). Douglas fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) dominate the forest, with an understory of Cascade Oregon grape (*Berberis nervosa*), salal (*Gaultheria shallon*), and creeping snowberry (*Symphoricarpos mollis*).

The 378-acre RNA is located in Linn County, Section 1 Township 15 South Range 2 West, on land administered by the BLM Eugene District. A portion of the meadow extends onto adjacent Weyerhaeuser private land. The Nature Conservancy has recently acquired a conservation easement on 45 acres of the Weyerhaeuser property, providing protection for the rocky bald and a buffer of adjacent forest. Meadows in Horse Rock Ridge RNA are accessed by hiking through old growth forest from BLM road number 15S-1W-18.2, parking at the quarry site in section 1, T15S R2W (see map). The area is accessed from the Shotgun Creek Road.

Plant Communities

Abrupt changes in soil depth create a sharp edge between old growth forest and grass bald. Photo by Cheshire Mayrsohn.

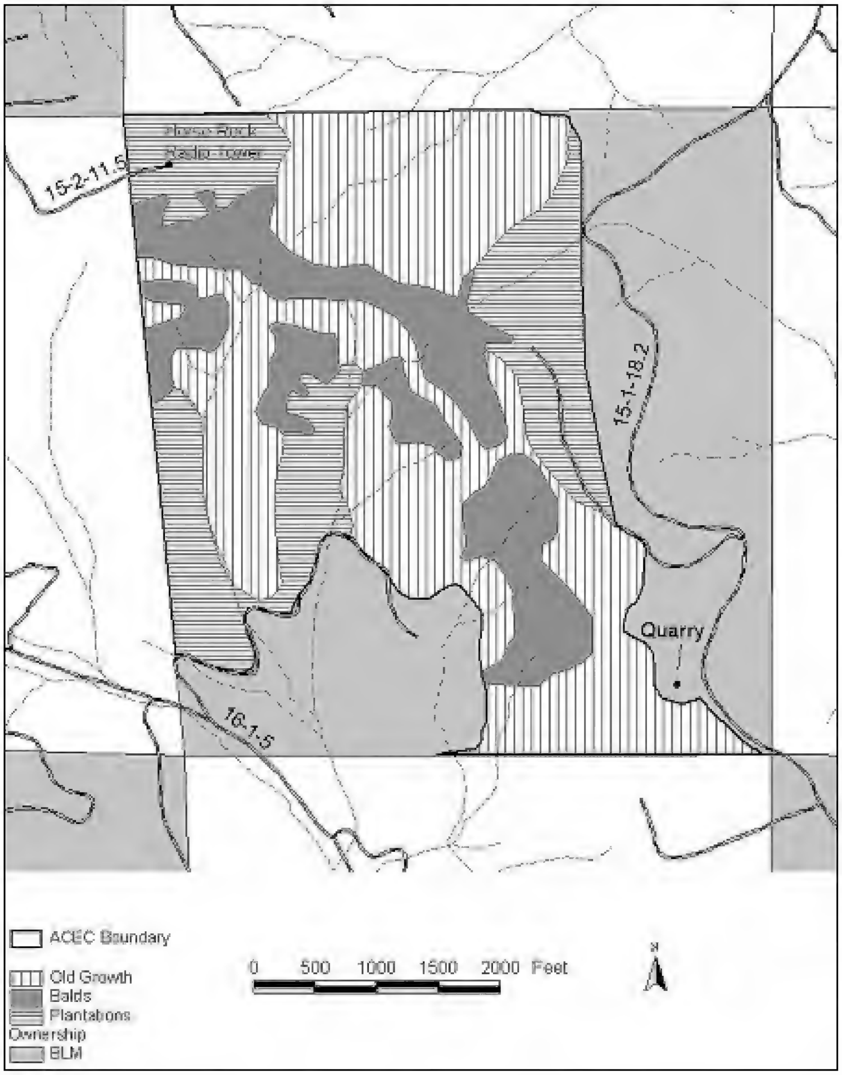
With 83 acres of openings, Horse Rock Ridge ranks among the largest grass balds in the western Cascades. In addition to grassy openings, the RNA protects forest and rock outcrop communities.

Many species occur in the meadows that are more typical of eastern Oregon, such as prairie junegrass (*Koeleria macrantha*), Sandberg bluegrass (*Poa secunda*) eyelash flower (*Blepharipappus scaber*), and deltoid balsamroot (*Balsamorhiza deltoidea*). Of the three meadow types, the Oregon fescue community occurs on the deepest soils. It is found in moist concave areas, where the soil eroding from surrounding areas was deposited. The blue wildrye community grows on somewhat shallower soils, and is the most widespread type. Lemmon's needlegrass/*Racomitrium canescens* communities occupy the shallowest, gravelly soils and rock outcrops. *Racomitrium* is a bryophyte common on rocky sites; the other species are native grasses. California oatgrass (*Danthonia californica*), prairie junegrass, and Sandberg bluegrass are also common native grasses in the meadows. Vernal pools, seeps, and springs in open areas support common monkeyflower (*Mimulus guttatus*), Nuttall's quillwort (*Isoetes nuttallii*), and Kellogg's rush (*Juncus kelloggii*). The pools are quite small, less than 7 feet in diameter. A succession of wildflowers begins in late April and runs through mid-July. Notable wildflowers include deltoid balsamroot, eyelash flower, hyacinth brodiaea (*Triteleia hyacinthina*), *Clarkia, Collinsia,* Menzies' larkspur (*Delphinium menziesii*), dwarf mountain fleabane (*Erigeron compositus* var. *glabratus*), barestem buckwheat (*Eriogonum nudum*), Oregon sunshine (*Eriophyllum lanatum*), common blue cup (*Githopsis specularioides*), spring gold (*Lomatium utriculatum*), and dwarf lupine (*Lupinus lepidus*).

Rock outcrops support a great diversity of lichens and bryophytes, including species of *Racomitrium* and *Umbilicaria*. In addition, rock outcrops provide habitat for a variety of vascular plants: American parsley fern (*Cryptogramma crispa*), gold back fern (*Pentagramma triangularis*), licorice fern (*Polypodium glycyrrhiza*), *Saxifraga*, *Sedum*, and Wallace's spikemoss (*Selaginella wallacei*).

A fringe of bristly manzanita (*Arctostaphylos columbiana*) occurs at the transition where the forest meets the grassland. It is often joined by Oregon white oak (*Quercus garryana*) and Pacific madrone (*Arbutus menziesii*). The forest/meadow ecotone appears to be relatively stable, as it generally consists of old trees, although a few younger trees are invading the meadows. Trees appear unable to grow in the driest, rockiest areas. Shrubs common in the ecotonal area include oceanspray (*Holodiscus discolor*), tall Oregon grape (*Berberis aquifolium*), poison oak (*Toxicodendron diversilobum*), and serviceberry (*Amelanchier alnifolia*).

About 293 acres are forested by stands of Douglas fir, bigleaf maple (*Acer macrophyllum*), western hemlock and western red cedar (*Thuja plicata*), with hemlock and cedar mostly on the north-facing slopes. The dense understory of



Map of Horse Rock Ridge.

shrubs and ferns includes salal, Cascade Oregon grape, creeping snowberry, and western swordfern (*Polystichum munitum*). Old growth Douglas fir, probably to 300 years old, reaches 150 feet tall and 5 feet in diameter. Wind-thrown trees that extend into the southern edges of some meadows are thought to date from the 1962 Columbus Day Storm. Where wind-thrown trees were accessible, they were salvaged by logging soon after the storms. Areas clearcut within the RNA prior to its establishment, about 100 acres, are now densely stocked with trees 8 inches in diameter, 28 to 38 years old. The old growth preserved by the RNA is isolated from other old growth stands because the private land surrounding the RNA was clearcut relatively recently. Over the past century, most of the forest land has been harvested in the Coburg Hills, where the pattern of ownership forms a checkerboard of private, federal, and state ownership.

In the foreground, bristly manzanita (*Arctostaphylos columbiana*) softens the ecotone between forest and grassland; in the background, a view to the east of the Coburg Hills. Photo by Cheshire Mayrsohn.

Rare Species

Four species located at the RNA are considered locally or regionally rare. Eyelash flower and common blue cup grow as widely scattered individuals in the meadows and rocky areas. These species are on the Lane County list C, meaning that they are of interest in Lane County for tracking or review purposes. (Although the RNA is in Linn County, it borders Lane County; hence the Lane County list was used to assess locally rare species). These two species are more common in eastern Oregon. The Lane County List of Rare and Endangered Vascular Plants, prepared by the Emerald Chapter of the Native Plant Society, indicates that these species are of limited occurrence in the county, and could be threatened by off road vehicle use. Eyelash flower is a small annual (to 16 inches) in the Asteraceae, with white flowers to ¾ inch across. The annual Campanulaceae, common blue cup, also grows to 16 inches tall, and has deep blue funnel shaped flowers that are about ½ inch long.

Vernally wet seeps or small pools within the balds support Kellogg's rush, a BLM Tracking species, Oregon Natural Heritage Program list 3. It is a small annual species, only 2 inches tall. It has thin stems topped by a small inflorescence, and basal, acicular leaves. Discovered in 1992, the few populations scattered across the RNA are small, most comprising fewer than 50 individuals each.

The crustose lichen *Lecidea dolodes* that grows on the trunks of open grown Douglas fir is currently a BLM Tracking species, and on the Oregon Natural Heritage Program list 3.

Meadows, rock outcrops, and forests form a mosaic in Horse Rock Ridge RNA. Photo by Cheshire Mayrsohn.

Geology and Soils

The Coburg Hills are a western extension of the Cascade foothills that rise from the east side of the Willamette Valley, bounded by the Calapooia River Valley on the north, and the Mohawk River Valley on the southeast. A main ridge divides the RNA so that about two thirds of the area, including the balds, faces southwest, while the rest faces northwest. Much of the RNA is steep and rocky, with elevations ranging from 1550 to 2864 feet.

The rocks consist of basalt and basaltic andesite dating from the Oligocene and early Miocene, about 24 million years ago. Vesicles formed by gases trapped in the lava were later filled by quartz and zeolite precipitated from water. Basalt with this feature is known as amygdaloidal. The amygdales can be found eroded from rock in the RNA. The prominent elongate rock outcrops in the RNA are the result of dikes of fine-grained basalt that formed in cracks in the amygdaloidal basalt. These dikes are more resistant to erosion than the surrounding rocks.

Erosion-resistant basalt dikes provide habitat for a variety of lichens, bryophytes, ferns, and native grasses. Photo by Cheshire Mayrsohn.

In the open areas, soils consist of rock outcrop and entisols, which are relatively young, poorly developed soils (i.e., lack well-defined diagnostic horizons). These entisols are shallow, generally 7 to 14 inches deep (up to 3 feet in partially forested areas), and contain a high proportion of gravel and cobble. In the forested area, most of the soils are in the Kinney Series (Curtis 2003). These soils derive from tuffaceous colluvium and consist of a 15-inch surface layer of cobbly loam over a subsoil of about 20 inches of cobbly clay loam. Depth to bedrock averages 4.5 feet.

Wildlife

Few wildlife surveys have occurred in the area, but a resident black bear, sometimes with cubs, has been sighted over a series of years. Sandhill cranes can be very numerous overhead during their migrations; they migrate along the foothills rather than over the central Willamette Valley. A spotted owl occurs within a mile of the RNA, which is within foraging range of the owl. Golden eagles have been reported near the RNA. It is likely that many other wildlife species use or travel through this area.

Human History

Native Americans of the Kalapuya tribes are thought to have frequented this site for vision quests, as high ridges with a view were generally preferred for these activities.

The meadow area is thought to have been heavily grazed by sheep early in the 20th century, but no grazing has occurred since at least the early 1960s. Evidence of grazing includes the abundance of introduced grasses, such as hedgehog dogtailgrass (*Cynosurus echinatus*), European silver hairgrass (*Aira caryophyllea*), soft brome (*Bromus hordeaceus*), ripgut brome (*B. rigidus*), and medusahead wildrye (*Taeniatherum caput-medusae*). Thirty-four introduced species have invaded the RNA, including the state-listed noxious weeds bull thistle (*Cirsium vulgare*), tansy ragwort (*Senecio jacobaea*), and St. John's wort (*Hypericum perforatum*). Much of the area previously occupied by a blue wildrye community is now dominated by introduced annual grasses. There have been no attempts to control non-native species in the RNA.

As mentioned previously, evidence of harvest activities are visible in portions of the RNA that were clearcut and replanted between 1960 and 1982. A trail created by hikers along the ridge receives occasional use. The RNA has been the destination for botany field

A hiking trail follows the prominent ridge that runs northwest-southeast across the RNA. Photo by Cheshire Mayrsohn.

trips by individuals and classes since the 1970s. A radio tower complex sits atop Horse Rock, in a young forest plantation, on land leased to the Bonneville Power Administration in the northwest corner of the RNA. In 2000, the BLM established permanent transects across the meadow/forest ecotone to monitor vegetation changes. Air quality is also being monitored by chemical analysis of lichens in the area.

Acknowledgments

Additional information was provided by Nancy Wogen and Cheshire Mayrsohn, botanists with the Eugene District BLM. The vascular plant list was compiled by Cheshire Mayrsohn, Nancy Wogen, Alan B. Curtis, John Christy, Peter Zika, Reid Schuller, and Bruce Newhouse. Dr. Bruce McCune compiled the lichen lists. John Christy and Bruce Newhouse compiled the bryophyte lists. All photographs are by Cheshire Mayrsohn.

References

Curtis AB. 2003. Horse Rock Ridge Research Natural Area: Guidebook Supplement 27. Portland (OR): USDA Forest Service Gen Tech Rep PNW-GTR-571. 30 p.

Vander Schaaf D. 1993. Horse Rock Ridge RNA/ACEC Management Plan (Draft). Unpublished document on file at BLM Eugene District office.

Vascular Plant Species List

Nomenclature for the vascular plants follows the Oregon Flora Project checklist. Names of taxa native to Oregon are printed in italic *Garamond*; alien taxa are in italic *Gill Sans*, a sans-serif type. Lists for nonvascular plants, fungi and lichens are available on the NPSO website, http://www.npsoregon.org/lists/plantlists/horse_rock_ridge.htm

FERNS AND THEIR ALLIES

DENNSTAEDTIACEAE (Bracken Family)
Pteridium aquilinum (L.) Kuhn var. *pubescens* Underw. (western brackenfern)
DRYOPTERIDACEAE (Wood Fern Family)
Athyrium filix-femina (L.) Mert. (lady fern)
Cystopteris fragilis (L.) Bernh. (brittle fern)
Polystichum munitum (Kaulfuss) K. Presl (western swordfern)
ISOETACEAE (Quillwort Family)
Isoetes nuttallii A. Br. (Nuttall's quillwort)
POLYPODIACEAE (Polypody Family)
Polypodium glycyrrhiza D.C. Eaton (licorice fern)
PTERIDACEAE (Brake Family)
Adiantum aleuticum (Rupr.) C.A. Paris (Aleutian maidenhair)
Aspidotis densa (Brack.) Lellinger (podfern)
Cheilanthes gracillima D.C. Eaton (lace lipfern)
Cryptogramma acrostichoides R. Br. (American parsley fern)
Pentagramma triangularis (Kaulf.) Yatsk., Windham, E. Wollenw. (gold back fern)
SELAGINELLACEAE (Spike-moss Family)
Selaginella wallacei Hieron. (Wallace's spikemoss)

GYMNOSPERMS

CUPRESSACEAE (Cypress Family)
Calocedrus decurrens (Torr.) Florin (incense cedar)
Thuja plicata D. Don (western red cedar)
PINACEAE (Pine Family)
Pseudotsuga menziesii (Mirbel) Franco var. *menziesii* (Douglas fir)
Tsuga heterophylla (Raf.) Sarg. (western hemlock)
TAXACEAE (Yew Family)
Taxus brevifolia Nutt. (Pacific yew)

DICOTYLEDONS

ACERACEAE (Maple Family)
Acer macrophyllum Pursh (bigleaf maple)
Acer circinatum Pursh (vine maple)
Acer glabrum Torr. var. *douglasii* (Hook.) Dippel (Douglas maple)
ANACARDIACEAE (Family)
Toxicodendron diversilobum (Torr. & A. Gray) Greene (poison oak)
APIACEAE (Carrot Family)
Daucus pusillus Michx. (American wild carrot)
Lomatium utriculatum (Nutt.) J.M. Coult. & Rose (spring gold)
Osmorhiza berteroi DC. (mountain sweet cicely)
Perideridia montana (Blank.) Dorn (Gairdner's yampah)
Sanicula bipinnatifida Douglas ex Hook. (purple snakeroot)
Sanicula crassicaulis Poepp. (Pacific snakeroot)
APOCYNACEAE (Dogbane Family)
Apocynum androsaemifolium L. (spreading dogbane)
ASTERACEAE (Sunflower Family)
Achillea millefolium L. (common yarrow)
Adenocaulon bicolor Hook. (pathfinder)
Anisocarpus madioides Nutt. (woodland tarweed)
Balsamorhiza deltoidea Nutt. (deltoid balsamroot)
Blepharipappus scaber Hook. (eyelash flower)
Cirsium vulgare (Savi) Ten. (bull thistle)
Erigeron compositus Pursh var. *glabratus* Macoun (dwarf mountain fleabane)
Eriophyllum lanatum (Pursh) J. Forbes (Oregon sunshine)
Gnaphalium palustre Nutt. (lowland cudweed)
Hemizonella minima (A. Gray) A. Gray (least tarweed)
Hieracium albiflorum Hook. (white flowered hawkweed)
Hypochaeris glabra L. (smooth cat's ear)
Hypochaeris radicata L. (rough cat's ear)
Lactuca muralis (L.) Fresen. (wall lettuce)
Leontodon hirtus L. (rough hawkbit)
Leucanthemum vulgare Lam. (oxeye daisy)
Madia exigua (Sm.) A. Gray (little tarweed)
Madia gracilis (Sm.) D.D. Keck (slender tarweed)
Senecio integerrimus Nutt. var. *exaltatus* (Nutt.) Cronquist (tall western groundsel)
Senecio jacobaea L. (tansy ragwort)
Sonchus asper (L.) Hill (prickly sowthistle)
Taraxacum officinale Weber ex F.H. Wigg. (common dandelion)
BERBERIDACEAE (Oregon-grape Family)
Achlys triphylla (Sm.) DC. (vanillaleaf)
Berberis aquifolium Pursh (tall Oregon grape)
Berberis nervosa Pursh (Cascade Oregon grape)
BETULACEAE (Birch Family)
Alnus rubra Bong. (red alder)

Corylus cornuta Marshall var. *californica* (A. DC.) W.M. Sharp (California hazelnut)
BORAGINACEAE (Borage Family)
Cryptantha intermedia (A. Gray) Greene (common cryptantha)
Myosotis discolor Pers. (yellow and blue scorpion grass)
Plagiobothrys scouleri (Hook. & Arn.) I.M. Johnst. var. *scouleri* (Scouler's popcorn flower)
BRASSICACEAE (Mustard Family)
Arabis glabra (L.) Bernh. (tower mustard)
Athysanus pusillus (Hook.) Greene (sandweed)
Barbarea orthoceras Ledeb. (American wintercress)
Brassica rapa L. (field mustard)
Cardamine oligosperma Nutt. (little western bittercress)
Cardamine pulcherrima Greene var. *tenella* (Pursh) C.L. Hitchc. (slender toothwort)
Draba verna L. (spring whitlowgrass)
Thysanocarpus curvipes Hook. (sand fringepod)
CALLITRICHACEAE (Water-starwort Family)
Callitriche heterophylla Pursh var. *bolanderi* (Hegelm.) Fassett (Bolander's water starwort)
Callitriche verna L. (spring starwort)
CAMPANULACEAE (Bellflower Family)
Campanula scouleri Hook. ex A. DC. (Scouler's harebell)
Githopsis specularioides Nutt. (common blue cup)
Heterocodon rariflorum Nutt. (heterocodon)
CAPRIFOLIACEAE (Honeysuckle Family)
Linnaea borealis L. var. *longiflora* Torr. (western twinflower)
Lonicera ciliosa (Pursh) Poir. ex DC. (orange honeysuckle)
Lonicera hispidula (Lindl.) Douglas ex Torr. & A. Gray (hairy honeysuckle)
Symphoricarpos albus (L.) S.F. Blake (common snowberry)
Symphoricarpos mollis Nutt. (creeping snowberry)
Viburnum edule (Michx.) Raf. (highbush cranberry)
CARYOPHYLLACEAE (Pink Family)
Arenaria serpyllifolia L. (thyme leaf sandwort)
Cerastium nutans Raf. (nodding chickweed)
Cerastium glomeratum Thuill. (sticky chickweed)
Minuartia tenella (Nutt.) Mattf. (slender sandwort)
Moehringia macrophylla (Hook.) Fenzl (bigleaf sandwort)
Silene gallica L. (windmill pink)
Stellaria nitens Nutt. (shining chickweed)
CELASTRACEAE (Staff-tree Family)
Paxistima myrsinites (Pursh) Raf. (Oregon boxwood)
CORNACEAE (Dogwood Family)
Cornus nuttallii Audubon ex Torr. & A. Gray (Pacific dogwood)
CUCURBITACEAE (Gourd Family)
Marah oreganus (Torr. & A. Gray) Howell (old man in the ground)
CRASSULACEAE (Stonecrop Family)
Sedum lanceolatum Torr. (lanceleaf stonecrop)
Sedum oreganum Nutt. (Oregon stonecrop)
Sedum spathulifolium Hook. (Pacific stonecrop)
ERICACEAE (Heath Family)
Arbutus menziesii Pursh (Pacific madrone)
Arctostaphylos columbiana Piper (bristly manzanita)
Chimaphila menziesii (R. Br.) Spreng. (little prince's pine)
Chimaphila umbellata (L.) W. Bartram (prince's pine)
Gaultheria shallon Pursh (salal)
Vaccinium parvifolium Sm. (red huckleberry)
EUPHORBIACEAE (Spurge Family)
Euphorbia peplus L. (petty spurge)
FABACEAE (Legume Family)
Lathyrus polyphyllus Nutt. (leafy peavine)
Lotus micranthus Benth. (field lotus)
Lupinus bicolor Lindl. (miniature lupine)
Lupinus lepidus Douglas ex Lindl. (dwarf lupine)
Rupertia physodes (Hook.) J.W. Grimes (scurf pea)
Trifolium microcephalum Pursh (woolly clover)
Trifolium microdon Hook. & Arn. (thimble clover)
Trifolium repens L. (white clover)
Trifolium subterraneum L. (subterranean clover)
Trifolium variegatum Nutt. (whitetip clover)
Trifolium willdenovii Spreng. (tomcat clover)
Trifolium wormskjoldii Lehm. (springbank clover)
Vicia americana Muhl. ex Willd. (American vetch)
Vicia nigracans Hook.& Arn. var. *gigantea* (Hook.) S.L. Broich (giant vetch)
FAGACEAE (Oak Family)
Chrysolepis chrysophylla (Douglas ex Hook.) Hjelmq. (chinquapin)
Quercus garryana Douglas ex Hook. (Oregon white oak)
FUMARIACEAE (Fumitory Family)
Dicentra formosa (Andrews) Walp. (bleeding heart)
GENTIANACEAE (Gentian Family)
Centaurium muhlenbergii (Griseb.) W. Wight ex Piper (Monterey centaury)
GERANIACEAE (Geranium Family)
Erodium cicutarium (L.) L'Hér. ex Aiton (redstem filaree)
Geranium dissectum L. (cutleaf geranium)
Geranium molle L. (dovefoot geranium)
GROSSULARIACEAE (Gooseberry Family)
Ribes sanguineum Pursh (red flowering currant)
HYDRANGEACEAE (Hydrangea Family)
Philadelphus lewisii Pursh (syringa)
Whipplea modesta Torr. (yerba de selva)
HYDROPHYLLACEAE (Waterleaf Family)
Nemophila parviflora Douglas ex Benth. (small flowered nemophila)
Phacelia linearis (Pursh) Holz. (threadleaf phacelia)
Phacelia nemoralis Greene (woodland phacelia)
Phacelia sericea (Graham) A. Gray var. *ciliosa* (Rydb.) J.M. Gillett (blue alpine phacelia)
HYPERICACEAE (St. John's Wort Family)
Hypericum perforatum L. (Klamathweed)
LAMIACEAE (Mint Family)
Prunella vulgaris L. (self heal)
Satureja douglasii (Benth.) Briq. (yerba buena)
Stachys cooleyae A. Heller (great betony)
Trichostema lanceolatum Benth. (vinegar weed)
LINACEAE (Flax Family)
Linum usitatissimum L. (linseed)
MALVACEAE (Mallow Family)
Sidalcea virgata Howell (rose checkermallow)
ONAGRACEAE (Evening Primrose Family)
Circaea alpina L. (enchanter's nightshade)
Clarkia amoena (Lehm.) A. Nelson & J.F. Macbr. (farewell to spring)
Clarkia gracilis (Piper) A. Nelson & J.F. Macbr. (slender godetia)
Clarkia purpurea (Curtis) A. Nelson & J.F. Macbr. (winecup fairyfan)
Epilobium brachycarpum C. Presl (tall annual willowherb)

Epilobium minutum Lindl. (small flowered willowherb)
OROBANCHACEAE (Broom-rape Family)
Orobanche fasciculata Nutt. (clustered broomrape)
Orobanche uniflora L. var. *minuta* (Suksd.) Beck (naked broomrape)
Orobanche uniflora L. var. *purpurea* (A. Heller) Achey (purple broomrape)
OXALIDACEAE (Oxalis Family)
Oxalis oregana Nutt. ex Torr. & A. Gray (Oregon wood sorrel)
PLANTAGINACEAE (Plantain Family)
Plantago lanceolata L. (English plantain)
POLEMONIACEAE (Phlox Family)
Collomia heterophylla Hook. (varied leaf collomia)
Gilia capitata Sims (bluefield gilia)
Linanthus bicolor (Nutt.) Greene (bicolored linanthus)
Phlox adsurgens Torr. (woodland phlox)
Phlox gracilis (Hook.) Greene (slender phlox)
POLYGONACEAE (Buckwheat Family)
Eriogonum nudum Douglas ex Benth. (barestem buckwheat)
Rumex acetosella L. (sheep sorrel)
Rumex crispus L. (curly dock)
PORTULACACEAE (Purslane Family)
Claytonia exigua Torr. & A. Gray ssp. *exigua* (pale springbeauty)
Claytonia perfoliata Donn ex Willd. (miner's lettuce)
Claytonia sibirica L. (candyflower)
Montia parvifolia (Moç. ex DC.) Greene (littleleaf miner's lettuce)
PRIMULACEAE (Primrose Family)
Dodecatheon hendersonii A. Gray (Henderson's shooting star)
Dodecatheon pulchellum (Raf.) Merr. var. *pulchellum* (yellowthroat shooting star)
Trientalis latifolia Hook. (western starflower)
RANUNCULACEAE (Buttercup Family)
Anemone deltoidea Hook. (threeleaf anemone)
Aquilegia formosa Fisch. ex DC. (red columbine)
Delphinium menziesii DC. (Menzies' larkspur)
Ranunculus occidentalis Nutt. var. *occidentalis* (western buttercup)
Thalictrum occidentale A. Gray (western meadowrue)
ROSACEAE (Rose Family)
Prunus emarginata (Douglas ex Hook.) Walp. (bitter cherry)
Amelanchier alnifolia (Nutt.) Nutt. ex M. Roem. (serviceberry)
Crataegus monogyna Jacq. (English hawthorn)
Fragaria vesca L. var. *crinita* (Rydb.) C.L. Hitchc. (hairy woodland strawberry)
Fragaria virginiana Duchesne var. *platypetala* (Rydb.) H.M. Hall (broad petal strawberry)
Holodiscus discolor (Pursh) Maxim. (creambush oceanspray)
Physocarpus capitatus (Pursh) Kuntze (Pacific ninebark)
Potentilla glandulosa Lindl. var. *glandulosa* (sticky cinquefoil)
Rosa gymnocarpa Nutt. (little wild rose)
Rubus leucodermis Douglas ex Torr. & A. Gray (western black raspberry)
Rubus parviflorus Nutt. (thimbleberry)
Rubus ursinus Cham. & Schltdl. (Pacific dewberry)
RHAMNACEAE (Buckthorn Family)
Rhamnus purshiana DC. (cascara)
Ceanothus sanguineus Pursh (redstem ceanothus)
Ceanothus velutinus Douglas ex Hook. (tobacco brush)
RUBIACEAE (Madder Family)
Galium oreganum Britton (Oregon bedstraw)
Galium aparine L. (cleavers)
Galium triflorum Michx. (sweetscented bedstraw)
Kelloggia galioides Torr. (kelloggia)
Sherardia arvensis L. (blue fieldmadder)
SALICACEAE (Willow Family)
Salix geyeriana Andersson (Geyer's willow)
Salix scouleriana Barratt ex Hook. (Scouler's willow)
Salix sitchensis Sanson ex Bong. (Sitka willow)
SAXIFRAGACEAE (Saxifrage Family)
Heuchera micrantha Douglas ex Lindl.var. *micrantha* (crevice alumroot)
Lithophragma parviflorum (Hook.) Nutt. ex Torr. & A. Gray (small-flowered fringecup)
Saxifraga cespitosa L. (tufted alpine saxifrage)
Saxifraga integrifolia Hook. (common western saxifrage)
Saxifraga nuttallii Small (Nuttall's saxifrage)
Saxifraga occidentalis S. Watson (western mountain saxifrage)
SCROPHULARIACEAE (Figwort Family)
Castilleja attenuata (A. Gray) T.I. Chuang & Heckard (narrowleaf paintbrush)
Castilleja hispida Benth. var. *hispida* (harsh paintbrush)
Castilleja tenuis (A. Heller) T.I. Chuang & Heckard (hairy owl clover)
Collinsia grandiflora Douglas ex Lindl. (large flowered blue eyed Mary)
Collinsia parviflora Douglas ex Lindl. (small flowered blue eyed Mary)
Digitalis purpurea L. (foxglove)
Gratiola ebracteata Benth. ex A. DC. (bractless hedge hyssop)
Mimulus alsinoides Douglas ex Benth. (chickweed monkeyflower)
Mimulus guttatus DC. (common monkeyflower)
Nothochelone nemorosa (Douglas ex Lindl.) Straw (woodland beardtongue)
Synthyris reniformis (Douglas ex Benth.) Benth. (snow queen)
Triphysaria pusilla (Benth.) T.I. Chuang & Heckard (dwarf owl clover)
Veronica arvensis L. (common speedwell)
VALERIANACEAE (Valerian Family)
Plectritis congesta (Lindl.) DC. (sea blush)
Valeriana sitchensis Bong. (mountain heliotrope)
VIOLACEAE (Violet Family)
Viola sempervirens Greene (evergreen violet)

MONOCOTYLEDONS

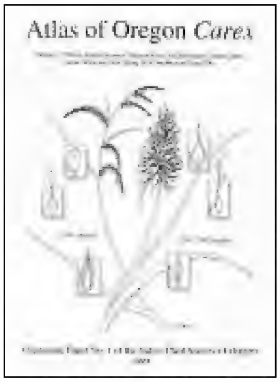
CYPERACEAE (Sedge Family)
Carex rossii W. Boott (Ross sedge)
IRIDACEAE (Iris Family)
Iris chrysophylla Howell (slender tubed iris)
Iris tenax Douglas ex Lindl. (Oregon iris)
JUNCACEAE (Rush Family)
Juncus bufonius L. (toad rush)
Juncus kelloggii Engelm. (Kellogg's rush)
Luzula comosa E. Mey. (Pacific woodrush)
LILIACEAE (Lily Family)
Allium acuminatum Hook. (tapertip onion)
Allium amplectens Torr. (slim leaf onion)
Allium crenulatum Wiegand (scalloped onion)
Brodiaea coronaria (Salisb.) Engl. (crown brodiaea)
Calochortus tolmiei Hook. & Arn. (Tolmie's mariposa)
Camassia leichtlinii (Baker) S. Watson (large camas)

Dichelostemma congestum (Sm.) Kunth (ookow)
Erythronium oreganum Applegate (Oregon fawnlily)
Fritillaria affinis (Schult.) Sealy (checker lily)
Maianthemum stellatum (L.) Link (starry false Solomon's seal)
Prosartes smithii (Hook.) Utech, Shinwari & Kawano (largeflower fairybells)
Trillium ovatum Pursh (western wakerobin)
Triteleia hyacinthina (Lindl.) Greene (hyacinth brodiaea)
Zigadenus venenosus S. Watson var. *venenosus* (meadow deathcamas)
POACEAE (Grass Family)
Achnatherum lemmoni (Vasey) Barkworth (Lemmon's needlegrass)
Agrostis capillaris L. (colonial bentgrass)
Agrostis exarata Trin. (spike bentgrass)
Aira caryophyllea L. (European silver hairgrass)
Aira praecox L. (little hairgrass)
Bromus hordeaceus L. ssp. *hordeaceus* (soft brome)
Bromus orcuttianus Vasey (Orcutt's brome)
Bromus pacificus Shear (Pacific brome)
Bromus rigidus Roth (ripgut brome)
Cynosurus echinatus L. (hedgehog dogtailgrass)
Danthonia californica Bol. (California oatgrass)
Elymus glaucus Buckley (blue wildrye)
Festuca occidentalis Hook. (western fescue)
Festuca roemeri Yu.E. Alexeev (Oregon fescue)
Festuca subulata Trin. (nodding fescue)
Holcus lanatus L. (common velvetgrass)
Hordeum marinum Huds. ssp. *gussonianum* (Parl.) Thell. (Mediterranean barley)
Koeleria macrantha (Ledeb.) Schult. (junegrass)
Melica subulata (Griseb.) Scribn. (Alaska oniongrass)
Poa pratensis L. (Kentucky bluegrass)
Poa secunda J. Presl (Sandberg bluegrass)
Trisetum canescens Buckley (tall trisetum)
Vulpia microstachys (Nutt.) Munro ex Benth. (small fescue)
Vulpia myuros (L.) C.C. Gmel. (foxtail fescue)
ORCHIDACEAE (Orchid Family)
Calypso bulbosa (L.) Oakes (fairyslipper orchid)
Corallorhiza maculata (Raf.) Raf. (spotted coralroot)
Goodyera oblongifolia Raf. (rattlesnake plantain)
Piperia elegans (Lindl.) Rydb. (elegant rein orchid)
Spiranthes romanzoffiana Cham. (hooded ladies tresses)

Douglas Goldenberg is a botanist currently working with the Eugene District BLM. He has worked since 1989 as a botanist, with work in Oregon, California, Washington and Brazil. He completed biology and botany degrees at Humboldt State University (BS) and Oregon State University (MS).

NPSO Occasional Papers

Atlas of Oregon Carex



Rich with information, a distillation of many decades of herbarium records and sightings by Oregon botanists. Contains 128 location maps, one for each Carex taxon in Oregon. Also included are a synonymy, fun facts about sedges, a history of the project, and Oregon geography maps. 29 pages.

Authors: Barbara L. Wilson, Richard Brainerd, Manuela Huso, Keli Kuykendall, Danna Lytjen, Bruce Newhouse, Nick Otting, Scott Sundberg, and Peter Zika.
Publication Date: May 1999. Price: $5.

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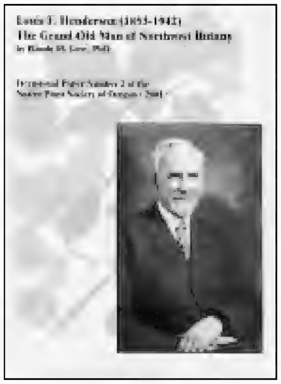

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Horse Rock Ridge

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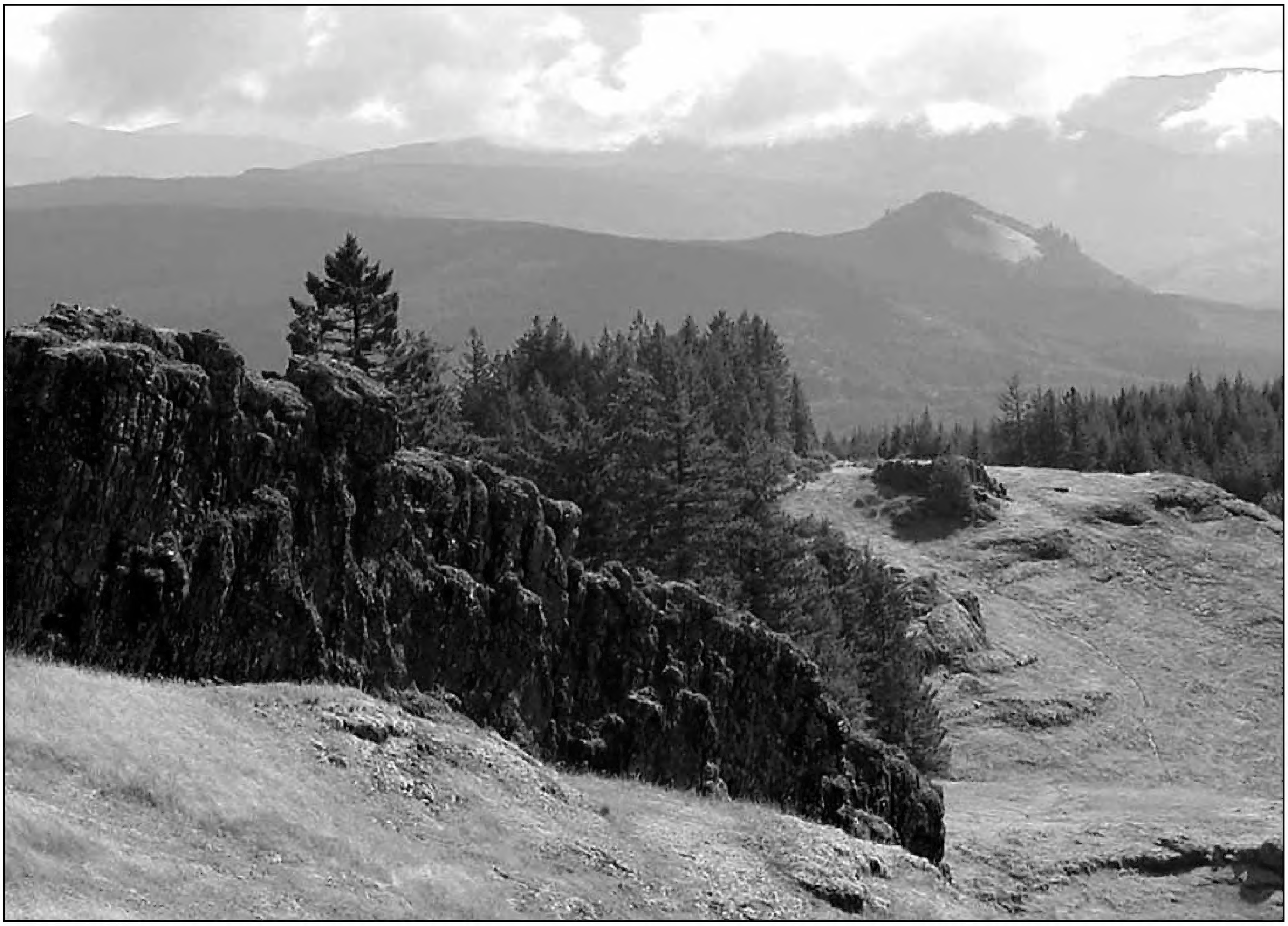


Fine-grained basaltic dikes resistant to weathering protrude from the surrounding terrain in Horse Rock Ridge RNA. Photo by Cheshire Mayrsohn.

The grassy balds of Horse Rock Ridge Research Natural Area (RNA) are found on ridges and south-facing slopes within the Douglas fir forest of the Coburg Hills. These natural grasslands in the foothills of the Cascades bordering the southern Willamette Valley have fascinated naturalists with their contrast to the surrounding forests. The RNA was established to protect these meadows which owe their existence to thin soils associated with rock outcroppings. Surrounding old growth forest adds to the value of the Natural Area.

The Bureau of Land Management (BLM) recognized the site's botanical, wildlife, and scenic values by establishing it as an RNA/ACEC in June 1995 (Eugene District Resource Management Plan 1995). It had previously been established as an Area of Critical Environmental Concern (ACEC) in 1984. Contrasting habitats of moist forests, dry meadows, and rock outcrops enhance species diversity. Many of the meadow species are more common in eastern Oregon. The meadows at the site represent three native communities defined by their dominant grass species: blue wildrye (*Elymus glaucus*), Oregon fescue (*Festuca roemeri*), and Lemmon's needlegrass (*Achnatherum lemmonii*)/hairy racomitrium moss *(Racomitrium canescens)* (Curtis 2003). Douglas fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) dominate the forest, with an understory of Cascade Oregon grape (*Berberis nervosa*), salal (*Gaultheria shallon*), and creeping snowberry (*Symphoricarpos mollis*).

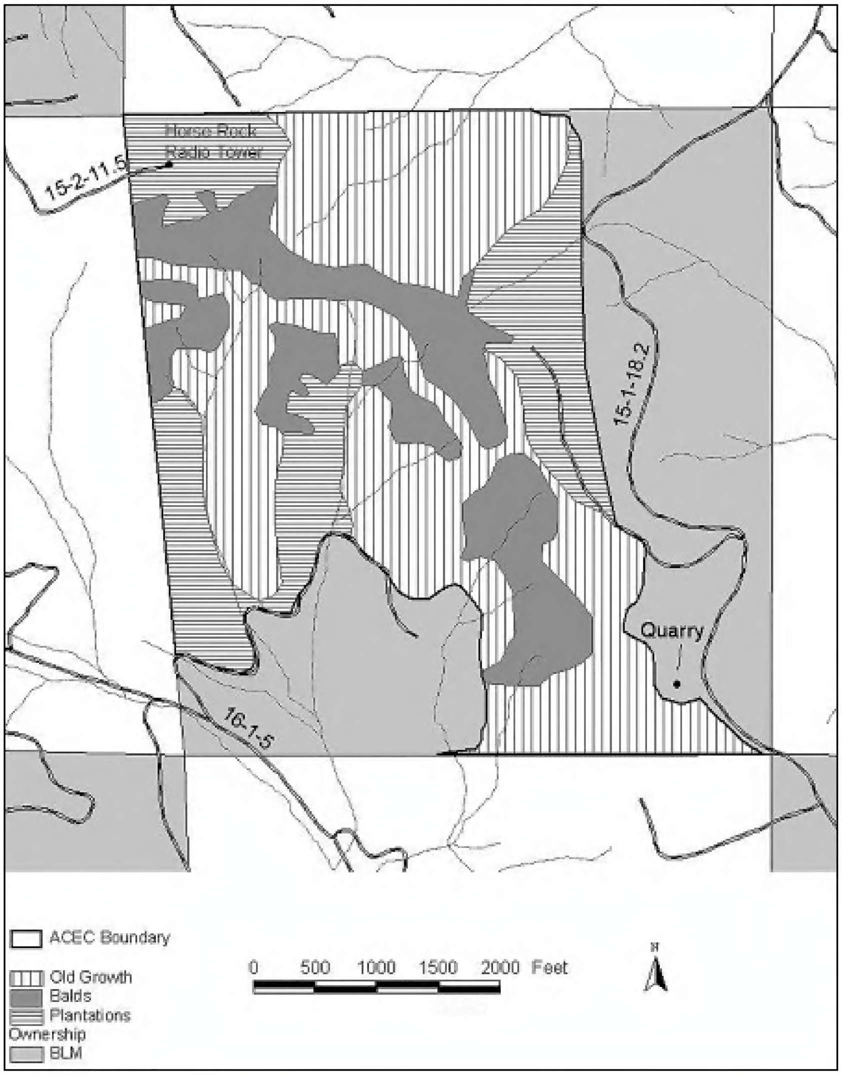
The 378-acre RNA is located in Linn County, Section 1 Township 15 South Range 2 West, on land administered by the BLM Eugene District. A portion of the meadow extends onto adjacent Weyerhaeuser private land. The Nature Conservancy has recently acquired a conservation easement on 45 acres of the Weyerhaeuser property, providing protection for the rocky bald and a buffer of adjacent forest. Meadows in Horse Rock Ridge RNA are accessed by hiking through old growth forest from BLM road number 15S-1W-18.2, parking at the quarry site in section 1, T15S R2W (see map). The area is accessed from the Shotgun Creek Road.

Plant Communities

With 83 acres of openings, Horse Rock Ridge ranks among the largest grass balds in the western Cascades. In addition to grassy openings, the RNA protects forest and rock outcrop communities.

Abrupt changes in soil depth create a sharp edge between old growth forest and grass bald. Photo by Cheshire Mayrsohn.

Many species occur in the meadows that are more typical of eastern Oregon, such as prairie junegrass (*Koeleria macrantha*), Sandberg bluegrass (*Poa secunda*) eyelash flower (*Blepharipappus scaber*), and deltoid balsamroot (*Balsamorhiza deltoidea*). Of the three meadow types, the Oregon fescue community occurs on the deepest soils. It is found in moist concave areas, where the soil eroding from surrounding areas was deposited. The blue wildrye community grows on somewhat shallower soils, and is the most widespread type. Lemmon's needlegrass/*Racomitrium canescens* communities occupy the shallowest, gravelly soils and rock outcrops. *Racomitrium* is a bryophyte common on rocky sites; the other species are native grasses. California oatgrass (*Danthonia californica*), prairie junegrass, and Sandberg bluegrass are also common native grasses in the meadows. Vernal pools, seeps, and springs in open areas support common monkeyflower (*Mimulus guttatus*), Nuttall's quillwort (*Isoetes nuttallii*), and Kellogg's rush (*Juncus kelloggii*). The pools are quite small, less than 7 feet in diameter. A succession of wildflowers begins in late April and runs through mid-July. Notable wildflowers include deltoid balsamroot, eyelash flower, hyacinth brodiaea (*Triteleia hyacinthina*), *Clarkia, Collinsia,* Menzies' larkspur (*Delphinium menziesii*), dwarf mountain fleabane (*Erigeron compositus* var. *glabratus*), barestem buckwheat (*Eriogonum nudum*), Oregon sunshine (*Eriophyllum lanatum*), common blue cup (*Githopsis specularioides*), spring gold (*Lomatium utriculatum*), and dwarf lupine (*Lupinus lepidus*).



Map of Horse Rock Ridge.

Rock outcrops support a great diversity of lichens and bryophytes, including species of *Racomitrium* and *Umbilicaria*. In addition, rock outcrops provide habitat for a variety of vascular plants: American parsley fern (*Cryptogramma crispa*), gold back fern (*Pentagramma triangularis*), licorice fern (*Polypodium glycyrrhiza*), *Saxifraga*, *Sedum*, and Wallace's spikemoss (*Selaginella wallacei*).

A fringe of bristly manzanita (*Arctostaphylos columbiana*) occurs at the transition where the forest meets the grassland. It is often joined by Oregon white oak (*Quercus garryana*) and Pacific madrone (*Arbutus menziesii*). The forest/meadow ecotone appears to be relatively stable, as it generally consists of old trees, although a few younger trees are invading the meadows. Trees appear unable to grow in the driest, rockiest areas. Shrubs common in the ecotonal area include oceanspray (*Holodiscus discolor*), tall Oregon grape (*Berberis aquifolium*), poison oak (*Toxicodendron diversilobum*), and serviceberry (*Amelanchier alnifolia*).

About 293 acres are forested by stands of Douglas fir, bigleaf maple (*Acer macrophyllum*), western hemlock and western red cedar (*Thuja plicata*), with hemlock and cedar mostly on the north-facing slopes. The dense understory of shrubs and ferns includes salal, Cascade Oregon grape, creeping snowberry, and western swordfern (*Polystichum munitum*). Old growth Douglas fir, probably to 300 years old, reaches 150 feet tall and 5 feet in diameter. Wind-thrown trees that extend into the southern edges of some meadows are thought to date from the 1962 Columbus Day Storm. Where wind-thrown trees were accessible, they were salvaged by logging soon after the storms. Areas clearcut within the RNA prior to its establishment, about 100 acres, are now densely stocked with trees 8 inches in diameter, 28 to 38 years old. The old growth preserved by the RNA is isolated from other old growth stands because the private land surrounding the RNA was clearcut relatively recently. Over the past century, most of the forest land has been harvested in the Coburg Hills, where the pattern of ownership forms a checkerboard of private, federal, and state ownership.

In the foreground, bristly manzanita (*Arctostaphylos columbiana*) softens the ecotone between forest and grassland; in the background, a view to the east of the Coburg Hills. Photo by Cheshire Mayrsohn.

Rare Species

Four species located at the RNA are considered locally or regionally rare. Eyelash flower and common blue cup grow as widely scattered individuals in the meadows and rocky areas. These species are on the Lane County list C, meaning that they are of interest in Lane County for tracking or review purposes. (Although the RNA is in Linn County, it borders Lane County; hence the Lane County list was used to assess locally rare species). These two species are more common in eastern Oregon. The Lane County List of Rare and Endangered Vascular Plants, prepared by the Emerald Chapter of the Native Plant Society, indicates that these species are of limited occurrence in the county, and could be threatened by off road vehicle use. Eyelash flower is a small annual (to 16 inches) in the Asteraceae, with white flowers to ¾ inch across. The annual Campanulaceae, common blue cup, also grows to 16 inches tall, and has deep blue funnel shaped flowers that are about ½ inch long.

Vernally wet seeps or small pools within the balds support Kellogg's rush, a BLM Tracking species, Oregon Natural Heritage Program list 3. It is a small annual species, only 2 inches tall. It has thin stems topped by a small inflorescence, and basal, acicular leaves. Discovered in 1992, the few populations scattered across the RNA are small, most comprising fewer than 50 individuals each.

The crustose lichen *Lecidea dolodes* that grows on the trunks of open grown Douglas fir is currently a BLM Tracking species, and on the Oregon Natural Heritage Program list 3.

Meadows, rock outcrops, and forests form a mosaic in Horse Rock Ridge RNA. Photo by Cheshire Mayrsohn.

Geology and Soils

The Coburg Hills are a western extension of the Cascade foothills that rise from the east side of the Willamette Valley, bounded by the Calapooia River Valley on the north, and the Mohawk River Valley on the southeast. A main ridge divides the RNA so that about two thirds of the area, including the balds, faces southwest, while the rest faces northwest. Much of the RNA is steep and rocky, with elevations ranging from 1550 to 2864 feet.

The rocks consist of basalt and basaltic andesite dating from the Oligocene and early Miocene, about 24 million years ago. Vesicles formed by gases trapped in the lava were later filled by quartz and zeolite precipitated from water. Basalt with this feature is known as amygdaloidal. The amygdales can be found eroded from rock in the RNA. The prominent elongate rock outcrops in the RNA are the result of dikes of fine-grained basalt that formed in cracks in the amygdaloidal basalt. These dikes are more resistant to erosion than the surrounding rocks.

Erosion-resistant basalt dikes provide habitat for a variety of lichens, bryophytes, ferns, and native grasses. Photo by Cheshire Mayrsohn.

In the open areas, soils consist of rock outcrop and entisols, which are relatively young, poorly developed soils (i.e., lack well-defined diagnostic horizons). These entisols are shallow, generally 7 to 14 inches deep (up to 3 feet in partially forested areas), and contain a high proportion of gravel and cobble. In the forested area, most of the soils are in the Kinney Series (Curtis 2003). These soils derive from tuffaceous colluvium and consist of a 15-inch surface layer of cobbly loam over a subsoil of about 20 inches of cobbly clay loam. Depth to bedrock averages 4.5 feet.

Wildlife

Few wildlife surveys have occurred in the area, but a resident black bear, sometimes with cubs, has been sighted over a series of years. Sandhill cranes can be very numerous overhead during their migrations; they migrate along the foothills rather than over the central Willamette Valley. A spotted owl occurs within a mile of the RNA, which is within foraging range of the owl. Golden eagles have been reported near the RNA. It is likely that many other wildlife species use or travel through this area.

Human History

Native Americans of the Kalapuya tribes are thought to have frequented this site for vision quests, as high ridges with a view were generally preferred for these activities.

The meadow area is thought to have been heavily grazed by sheep early in the 20th century, but no grazing has occurred since at least the early 1960s. Evidence of grazing includes the abundance of introduced grasses, such as hedgehog dogtailgrass (*Cynosurus echinatus*), European silver hairgrass (*Aira caryophyllea*), soft brome (*Bromus hordeaceus*), ripgut brome (*B. rigidus*), and medusahead wildrye (*Taeniatherum caput-medusae*). Thirty-four introduced species have invaded the RNA, including the state-listed noxious weeds bull thistle (*Cirsium vulgare*), tansy ragwort (*Senecio jacobaea*), and St. John's wort (*Hypericum perforatum*). Much of the area previously occupied by a blue wildrye community is now dominated by introduced annual grasses. There have been no attempts to control non-native species in the RNA.

As mentioned previously, evidence of harvest activities are visible in portions of the RNA that were clearcut and replanted between 1960 and 1982. A trail created by hikers along the ridge receives occasional use. The RNA has been the destination for botany field

A hiking trail follows the prominent ridge that runs northwest-southeast across the RNA. Photo by Cheshire Mayrsohn.